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CITRUS-CULTURE.

VARIETY AND ROOT-STOCK EXPERIMEMTS AT TAURANGA.

FRESH citrus-fruits imported into New Zealand during the year 1924 were valued at £107,296 at the port of origin—not including the importation of such by-products as lime-juice and lemon-squash, jams, syrups, and peel. Under such circumstances the movement to establish commercial citrus-groves in the Dominion can be understood, seeing that it has been demonstrated many times and in a number of places that these fruits can be grown here, and that in some instances the local product is equal in quality to the best of the imported goods.

Definite progress in the establishment of commercial plantations, however, has been hindered by the lack of knowledge of the most suitable commercial varieties, and stocks on which to graft them, for the different districts. The kinds and varieties of citrus and stocks suitable for each are subject to the same unaccountable vagaries as other plants. Varieties and stocks commercially satisfactory in one district are not so good in another. At Tauranga it has been amply demonstrated that the climate and much of the land are eminently suitable for the commercial production of citrus-fruits. On the Horticultural Station of the Department of Agriculture there some seven years ago plantings were made of different varieties of lemons, limes, oranges, and grapefruit; some of them on three or four different kinds of stocks. The results are being watched with interest, and it is anticipated that conclusions will be demonstrated that will be of great value to the citrus industry in that locality, and useful in some degree to other districts.

When the Tauranga Horticultural Station was disposed of in 1923 the Manager, Mr. J. H. Davidson, took over the homestead block and undertook the completion of the citrus experiments already under way. The following is a progress report recently made by him to the Department:—

No. 1 area, with which this report deals, consists of approximately 7 acres, comprising 493 lemon-trees and 145 trees of various sweet

oranges, grapefruit, and limes. The area was planted in August, 1918, with the exception of the stock-testing block, two rows of Genoa lemons, and about half of the sweet oranges, which were completed in the following spring.

Taking into consideration the poor condition of the block of land previous to it being planted in citrus-trees, and looking over it now, it must be admitted that the trees have done remarkably well. With the exception of the Lisbon lemon block, they have settled down to bearing.

LEMON AND ORANGE VARIETY TESTS.

LEMONS.

Eureka.—This variety has probably outstripped the others in growth and productiveness. While it is generally admitted in the Tauranga district that this variety gets away more quickly during the first few years than the other sorts and also comes into fruiting sooner, it has had the advantage over the others here in being situated next to the shelter hedge protecting the area from the prevailing south-westerly winds. The trees are worked on the common or rough lemon seedling root-stocks (*Citronella*). Picking commenced in 1922, and the average crop for the season ended 31st March, 1925, was two and a half cases of green fruit per tree, taking 150 fruits per case.

Lisbon.—This block of trees is the poorest in the area. They were a nasty lot when they came from the nursery, the root-stocks being old and stunted. The following season after planting the poorest of them were lifted and destroyed. In spite of the fact that they receive the same manurial treatment as the other sorts they do not respond as they ought to. Many of the trees have not yet borne any fruit, and the average picking for the block last season was approximately one quarter-case of fruit per tree.

Villa Franca.—The block marked "Messina" on the plan should now be included under this variety, as, with the exception of a few trees planted to replace stunted ones removed, they are all of the Villa Franca variety. The trees in the stock-testing block are the true Messina variety, and are dealt with under that heading. Villa Franca is undoubtedly a very promising variety for Tauranga conditions. It has the same advantage as the Eureka variety, of being a vigorous grower and an early bearer. The general habit of the tree is stocky and rigid. The branches are much shorter-jointed and less drooping than those of the Eureka, and the tree is therefore better suited for exposed situations. The fruit produced on young trees is decidedly of poor quality. The nipple does not grow out, which makes the fruit too round and rough looking. This condition has prevailed here more or less until this season, when the fruit is now mostly of first-class quality. It is also a heavier summer-bearing variety than the Eureka or Lisbon, and this is decidedly in its favour. Villa Franca promises to be one of the best for commercial planting in the district. Although more will be known of its general characteristics two years hence, I have every confidence in recommending it for planting at the present time. The average crop picked last season was two cases of fruit per tree.

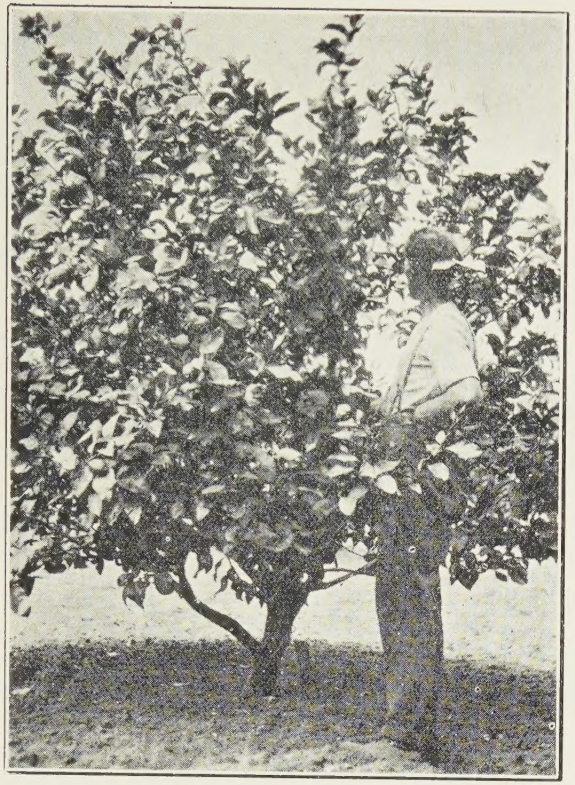

FIG. 1. EUREKA LEMON ON SWEET-ORANGE SEEDLING STOCK.

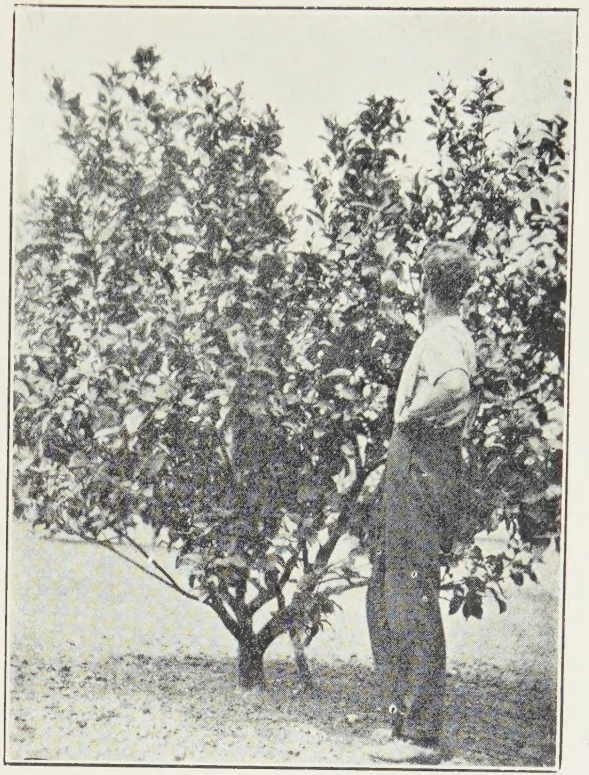

FIG. 2. EUREKA ON LEMON SEEDLING STOCK.

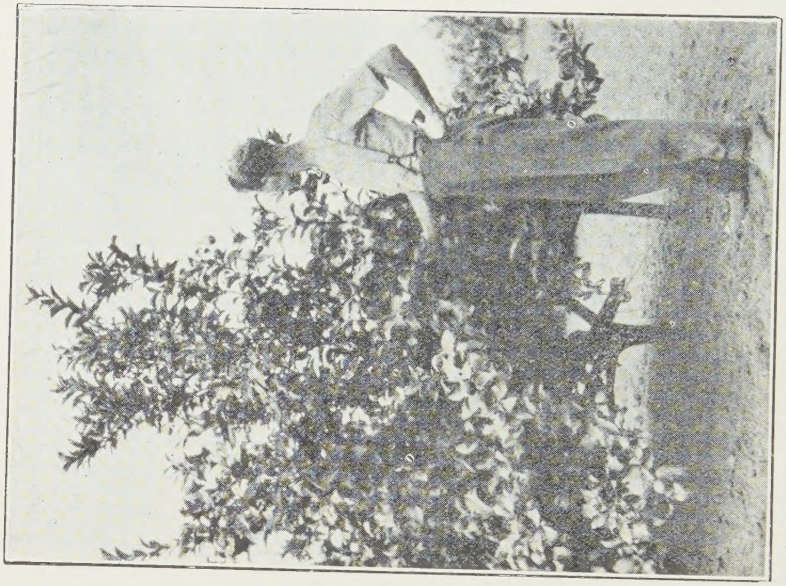

FIG. 4. EUREKA ON RANGPUR LIME SEEDLING.

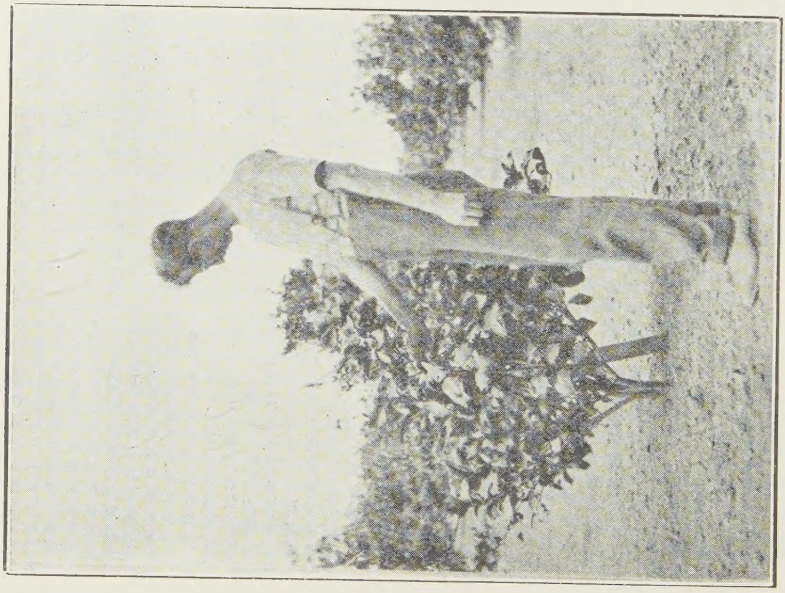

FIG. 3. EUREKA ON CITRUS TRIFOLIATA SEEDLING.

Messina.—The few trees growing here are poor in comparison with the other varieties. The general habit of the trees is to form tall and upright growths, which are very thorny. Hard pruning is now being tried in order to induce the trees to spread. The first fruits borne were quite elongated. The quality was fair, but their shape made them unsuitable for commercial purposes otherwise than for the factory for making squash. However, the fruit picked this season has decidedly improved. The trees have borne little fruit as yet, and there is little to recommend it.

Genoa.—One row of trees was planted in August, 1918. As soon as growth was made and buds procurable, stocks were worked in the nursery and planted out in September, 1920. Genoa is practically unknown in New Zealand, and it will be difficult to say with any degree of certainty whether we have the true variety or not. It is, however, distinct from all the other varieties. It has the drooping habit of the Eureka, but with finer foliage and growth, and the fruit and fruiting-qualities somewhat resemble those of Villa Franca. Genoa is a heavy summer cropper. The original row of trees are worked on rough lemon root-stocks, and have grown equally well as Eureka and Villa Franca. The average crop picked last season was two and a quarter cases of green fruit per tree. The other two rows of Genoa are worked on Island sweet-orange seedling stocks. They are not growing so vigorously as those on the rough lemon, and this is probably wholly due to their heavy-cropping qualities. The trees commenced to bear fruit two years after planting, and at the same time as the original row from which they were worked. The fruit is of first-class quality, and the average crop for these small trees last season was one case per tree. Genoa is little known in citrus-growing countries, rendering it difficult to get a proper description of the tree, and whether those here are true or not is problematic. I can, however, recommend the variety for Tauranga conditions, and, as the trees settle down to heavy bearing, I anticipate it will be the best variety here.

Persian (sweet) and Rangpur (acid) Limes.—These are very vigorous growers, but the fruit is of no commercial value whatever.

ORANGES.

Best's Seedless.—This is a very disappointing variety on account of the long time it takes to come into fruiting. It has too much of the wild-seedling type about it, but this could probably be modified by selecting buds only from fruiting trees. There is one tree here worked on the lime, and which bore five fruits the third season from budding.

Ruby (Blood).—These trees are worked on sweet stocks, and are just commencing to bear fruit.

Washington Navel.—Trees on sweet-orange stocks are now in bearing, and are making fair growth. Those worked on the lime are dwarfs. This stock appears to be quite unsuitable for the Washington Navel.

Navelencia.—All the trees are worked on sweet stocks, and are growing vigorously and bearing fruit. It is a more robust grower

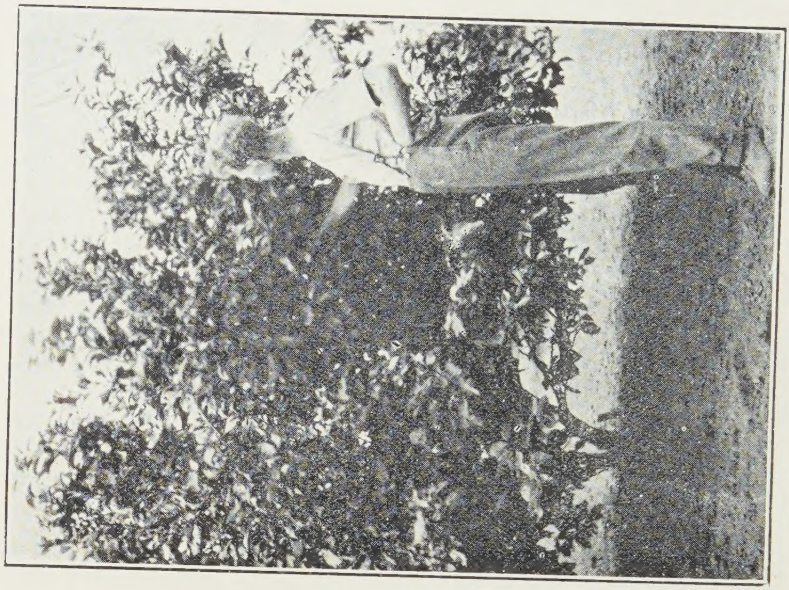

FIG. 6. LISBON ON LEMON SEEDLING STOCK.

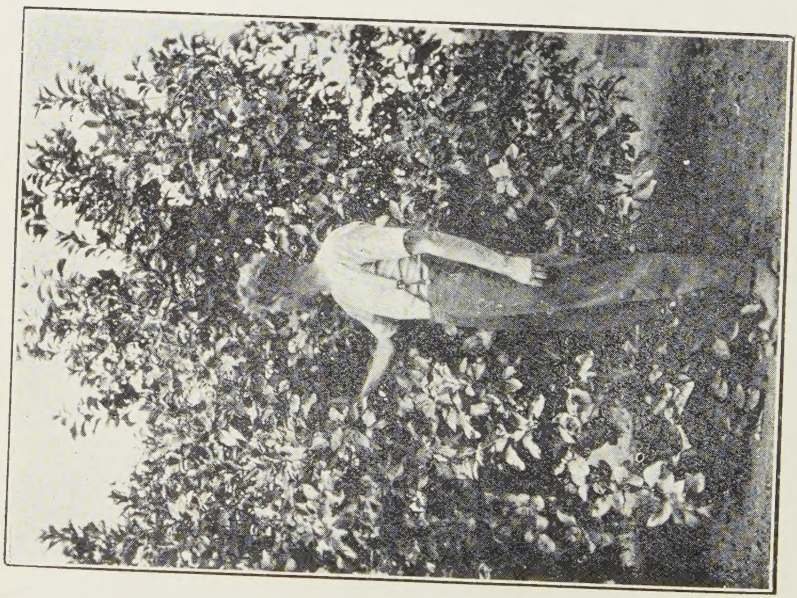

FIG. 5. LISBON LEMON ON SWEET-ORANGE SEEDLING STOCK.

FIG. 8. LISBON ON RANGPUR LIME SEEDLING.

FIG. 7. LISBON ON CITRUS TRIFOLIATA SEEDLING.

than the Washington Navel. The fruit is more attractive in appearance, and is also of better quality. It also has the advantage of hanging on the tree six or eight weeks longer than the Washington. In fact, Washington should be picked before they are properly coloured, as they soon become dry if left on the trees after they are ripe.

Thompson's Improved Navel.—The trees are worked on both sweet-orange and lime root-stocks, and are doing equally well on both of them. The fruit is somewhat ribbed, which rather detracts from its appearance, but the quality is probably the best of all, while the fruit hangs on the trees as long as the Navelencia, and does not become dry like the Washington.

St. Michael.—The trees are worked on sweet-orange and lime stocks, and are growing and fruiting about evenly. Fruit is small, and ripens too early to be of much commercial value.

Joppa and Jaffa.- These are worked on sweet-orange stocks, and are growing well. They are rather shy bearers so far, and the fruit is only second-rate in quality. Both sorts are thick-skinned.

Poorman.—The trees are worked on lime and sweet-orange stocks, and are growing and bearing about evenly, although those on the lime stock commenced to bear a year earlier.

Grapefruit.—These are growing and bearing well, but the fruit is of little commercial value on account of the skin being too thick.

LEMON ROOT-STOCK TESTS.

Four trees at the end of each row of lemons are worked on various root-stocks. The crops indicated in the following notes are the average of the four trees on each kind of stock, the count being based at the rate of 150 lemons per case for the season ended March, 1925.

(1.) Eureka on sweet-orange seedling (Fig. 1): Trees are making good growth. Stock well suited for this variety. Yield, $1\frac{3}{4}$ cases fruit per tree.

(2.) Eureka on lemon seedling (Fig. 2): Trees similar in growth and appearance to No. 1. Growth probably a little finer. Crop, 1 case fruit per tree.

(3.) Eureka on *Citrus trifoliata* seedling (Fig. 3): A useless stock for Tauranga soil-conditions—too slow and dwarfing. Crop, $\frac{3}{4}$ case per tree.

(4.) Eureka on Rangpur lime seedling (Fig. 4): Trees have been badly blown, and growth somewhat retarded. Came into bearing early, and the fruit is usually of high quality. Though the trees are dwarfer than No. 1 and No. 2 they carry good crops, the average being $1\frac{1}{2}$ cases per tree.

(5.) Lisbon on sweet orange (Fig. 5): The most vigorous trees in the whole area, and in consequence the crop is light for the size of the trees. This condition, however, will quickly change as growth slows down. Crop, $1\frac{2}{3}$ cases per tree.

(6.) Lisbon on lemon (Fig. 6): Vigorous-growing trees, though not up to the standard of No. 5. Crop, 1 case per tree.

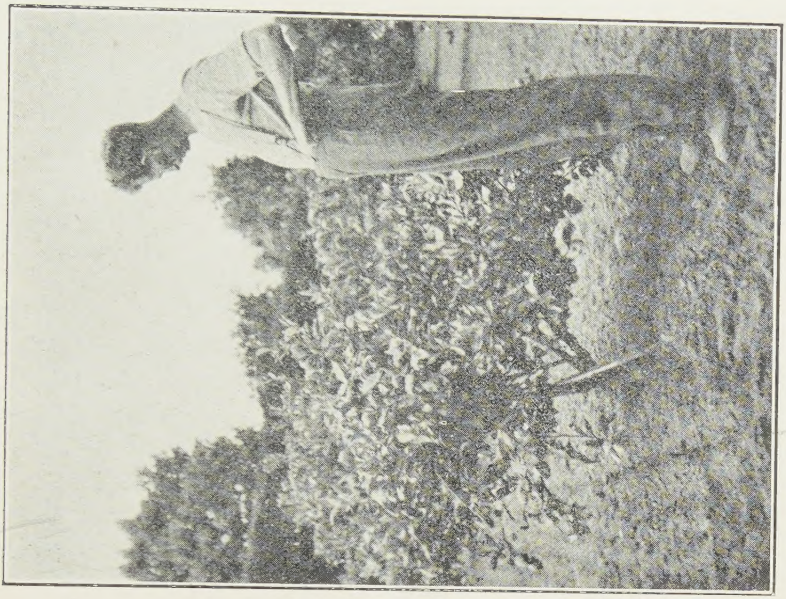

FIG. 10. VILLA FRANCA ON CITRUS TRIFOLIATA SEEDLING.

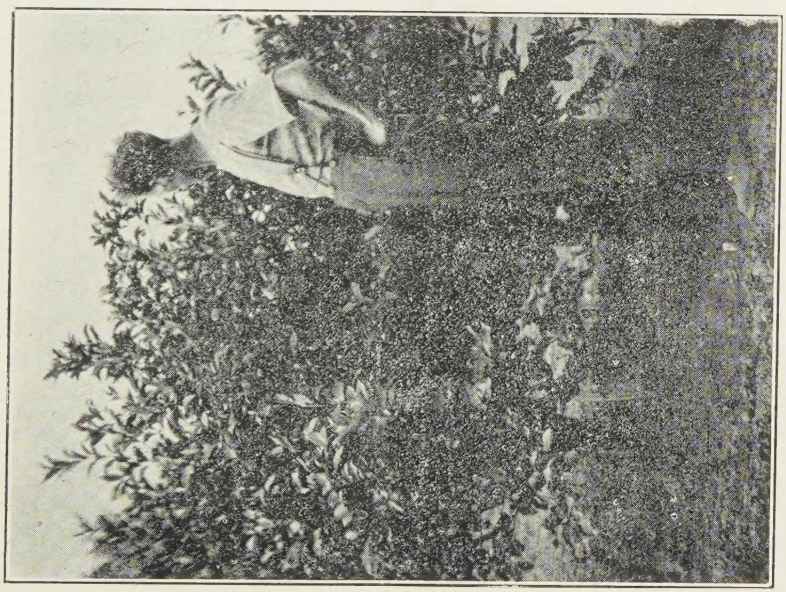

FIG. 9. VILLA FRANCA LEMON ON LEMON SEEDLING STOCK.

FIG. 12. MESSINA LEMON ON LEMON SEEDLING STOCK.

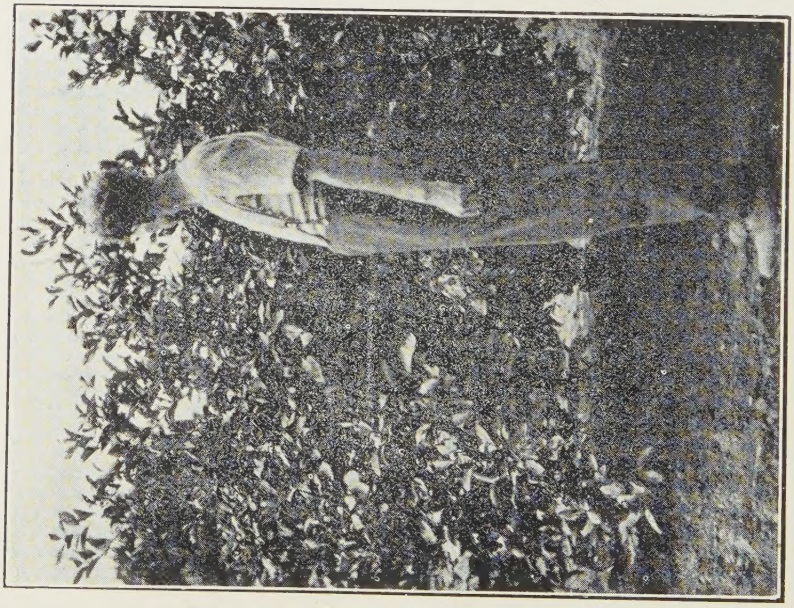

FIG. 11. VILLA FRANCA ON RANGPUR LIME.

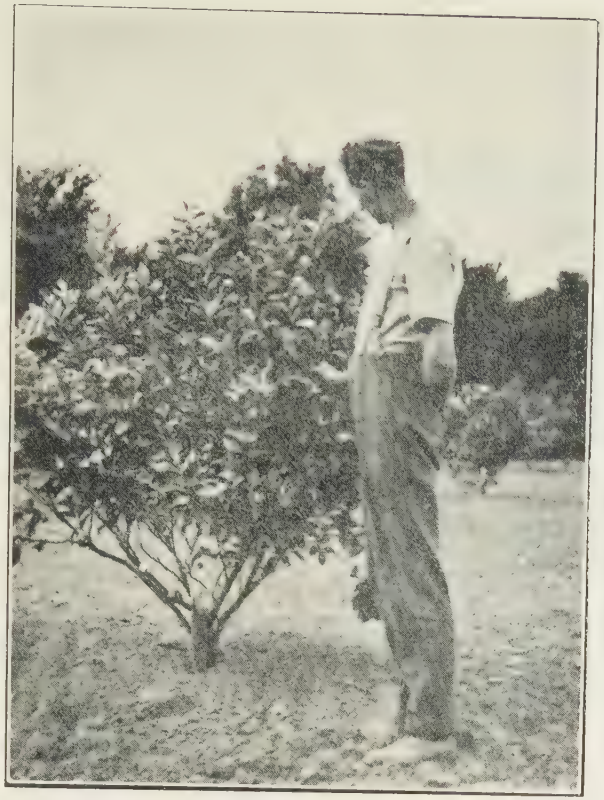

FIG. 13. MESSINA ON CITRUS TRIFOLIATA.

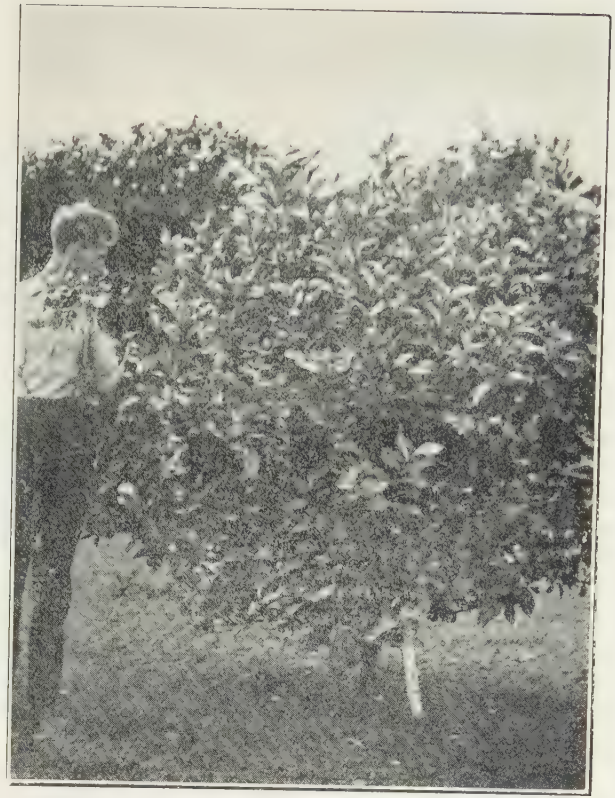

FIG. 14. MESSINA ON RANGPUR LIME.

(7.) Lisbon on *C. trifoliata* (Fig. 7): Trees doing much better than No. 3, and are bearing well. It is, however, too dwarfing. Crop, 2 cases per tree.

(8.) Lisbon on Rangpur lime (Fig. 8): One whole row is planted on this root-stock. Trees are vigorous and healthy. Six trees continue to bear rough fruit, and if no improvement shows they will be reworked. Several of the trees were severely blown about; two of them were entirely blown out of the ground, the root-system being so damaged that they had to be removed. The rooting-system of the lime is not

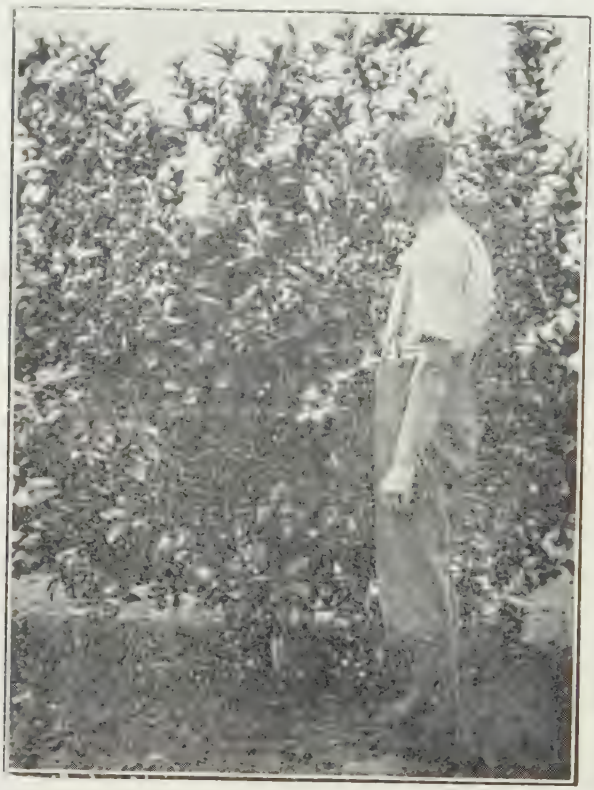

FIG. 15. GENOA LEMON ON LEMON SEEDLING STOCK.

so deep as that of the lemon or orange, which is rather a disadvantage. Lisbon is more vigorous on this stock than Eureka. Crop, 1½ cases per tree.

(9.) Villa Franca on lemon (Fig. 9): Trees are not so vigorous as they ought to be, but will probably make good ones yet. Crop, ½ case per tree.

(10.) Villa Franca on *C. trifoliata* (Fig. 10): A poor lot. Crop, ⅔ case per tree.

(11.) Villa Franca on lime (Fig. 11): Very promising; growth not too vigorous; well clothed with fruiting-wood. Crop, 1½ cases per tree.

(12.) Messina on lemon (Fig. 12): Average trees, and growing well. Doubtful if variety is suited to our conditions. Crop, $\frac{1}{5}$ case per tree.

(13.) Messina on *C. trifoliata* (Fig. 13): Of no value whatever. Crop, $\frac{1}{5}$ case.

(14.) Messina on lime (Fig. 14): Most promising trees of this variety, making nice growth and fruiting freely. Crop, $1\frac{3}{5}$ cases per tree.

FIG. 16. GENOA ON CITRUS TRIFOLIATA.

(15.) Genoa on lemon (Fig. 15): One row; a fine lot of trees, bearing well. Crop, $2\frac{1}{2}$ cases per tree.

(16.) Genoa on *C. trifoliata* (Fig. 16): Too dwarf. Crop, 1 case per tree.

(17.) Genoa on lime (Fig. 17): I consider these the best trees in the whole area. Their habit of growth and quality of fruit are almost perfection. The next two years should determine whether these ideal conditions are likely to be fixed or not. Crop, $1\frac{2}{3}$ cases per tree.

The accompanying photographs, taken last season by Mr. W. C. Hyde, the Department's Horticulturist, convey a good idea of how the different varieties are shaping on the various root-stocks in use.

CULTIVATION.

The area has been under clean cultivation until this season, when the method was altered a little and a growth of soft weeds allowed to grow for three months. The quality of the fruit was decidedly off last season, and I began to wonder whether we were not overcultivating. The quality is now greatly improved, but this season has been much drier than the last. This is a matter that requires careful investigation here over a period of years, and, of course, the method indicated should not be attempted in any orchard that is not free from couch-

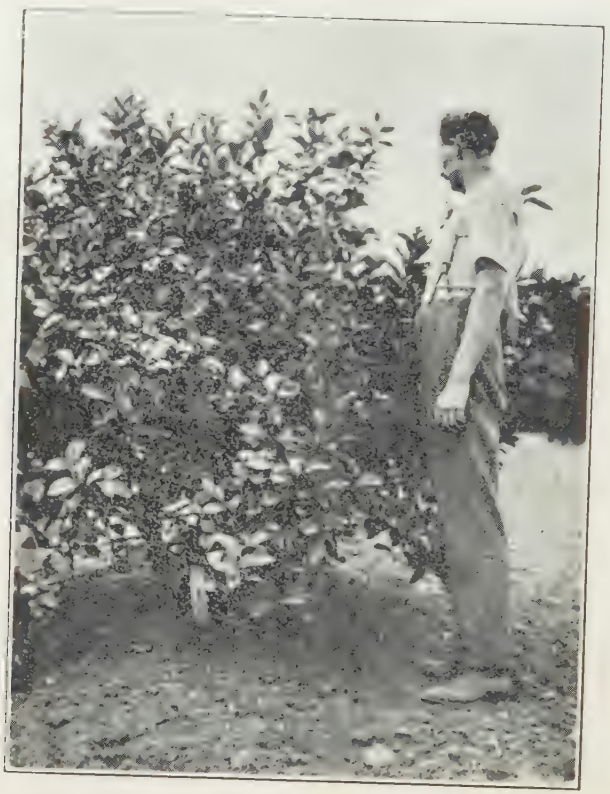

FIG. 17. GENOA LEMON ON RANGPUR LIME STOCK.

grass. The plough is not used in this orchard at all. Cover crops are disked in, and the Harvey one-way disk has been found to be all that is claimed for it. The tine harrows are preferred to the Planet Jr. cultivator, as they do not disturb the soil so deeply.

For maintenance requirements of the dairy cow about ¾ lb. of protein and 7 lb. of other digestible nutriments are necessary per day. Each pound of butterfat yielded requires 1 lb. of protein and 5 lb. of other nutrients. Hence, for maintenance, foods comparatively low in protein are efficient, but for milk-production highly nitrogenous foods are necessary.

STINKING-SMUT OF WHEAT.

IV. EXPERIMENTAL RESULTS FOR SEASON 1925–26

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

THE experimental results presented in the accompanying table confirm in general the results given by last season's work. Two methods of seed-treatment stand out as the best under present conditions in New Zealand. These are the formalin-steep and the copper-carbonate-dust treatments. Other materials such as Semesan, Uspulun, and Germisan, though offering interesting possibilities in the direction of seed stimulation combined with disease-control, are not yet procurable by farmers in this country. This objection also applies to copper carbonate, but arrangements are in hand to have both the material and machines available to treat a reasonable area of next season's seed wheat with this material.

SUMMARY OF RESULTS.

(For details of materials and methods see article II of this series, published in the *Journal* for May, 1925, Vol. 30, p. 302.)

Copper Carbonate.—The higher-grade copper-carbonate dust (No. 2), containing 54 per cent. copper, and used at 2 oz. per bushel, gave complete control of the smut, with, on the whole, a slight improvement in plants and heads over the untreated seed. The lower-grade product (No. 1), containing 26 per cent. copper, and used at 4 oz. per bushel, failed to completely control the smut and slightly damaged the seed.

Corona 640 and 640 S, Dupont 13 and 30, are new dust disinfectants from the United States not yet beyond the experimental stage. They all appear to be less effective in smut-control than copper carbonate, and would probably be much more expensive.

Semesan, used both as a dust at 1 oz. per bushel and as a steep at 0·2 per cent. for one hour, gave nearly complete control of the smut, with a slight increase of plants and heads as compared with the adjacent rows of untreated seed.

Uspulun and Germisan gave results not quite so good as those recorded last year. As the material was at least three years old it may have deteriorated.

Clarke's Wheat Protector gave complete control of the smut, but showed a good deal of injury to the seed.

Bluestone, used both at 1 per cent. (1 lb. to 10 gallons) and 2 per cent. (1 lb. to 5 gallons), gave complete control of the smut, with much damage to the seed.

Formalin, used at a strength of 1–320 (1 pint to 40 gallons) and at 1–480 (1 pint to 60 gallons), completely controlled the smut, but considerably lowered the vitality of the seed, especially that of the variety Velvet Chaff. It would be advisable in practice to use the 1 pint in 60 gallons rather than the 1 pint in 40 gallons strength now generally used. Presoaking the seed in water for six hours before treatment again greatly reduced the damage caused by the dip.

The samples of wheat used in the experiments, kindly supplied by Mr. C. H. Hewlett, manager of the Canterbury Seed Company,

Experiments on Stinking-smut of Wheat, Season 1925–26.

Treatment.	Velvet Chaff.										College Hunter's.										Solid-straw Tuscan									
	Percentage Germination.				Plants.			Heads.			Percentage Germination.				Plants.			Heads.			Percentage Germination.				Plants.			Heads.		
	In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
		First Count.										First Count.										First Count.								
		%	P.E. ±	Mature Plants.								%	P.E. ±	Mature Plants.								%	P.E. ±	Mature Plants.						
Control ..	97·7	86·0	1·04	85·0	170	24	14·1	551	60	10·9	98·7	96·0	0·78	92·0	184	34	18·5	71	11	15·5	98·0	92·0	1·08	89·5	179	15	8·4	580	42	7·2
Copper carbonate No. 1, 4 oz. ..	99·7	91·5	0·87	90·5	362	2	0·5	1,122	5	0·4	100·0	91·3	0·90	87·3	349	0	0·0	1,407	0	0·0	98·0	94·3	1·08	92·3	369	0	0·0	990	0	0·0
Control ..	97·7	90·0	1·20	90·0	180	30	16·6	584	74	12·7	98·7	90·0	0·80	89·5	179	57	31·9	703	173	22·0	98·0	94·0	1·06	90·5	182	3	1·6	485	5	1·0
Copper carbonate No. 1, 2 oz. ..	99·5	92·5	0·95	91·3	393	0	0·0	1,145	0	0·0	98·7	91·3	0·83	90·3	361	0	0·0	1,559	0	0·0	97·3	92·5	0·92	91·5	366	0	0·0	1,019	0	0·0
Control ..	97·7	90·5	1·13	87·5	175	42	24·0	586	104	17·8	98·7	91·5	1·12	91·5	183	56	30·6	756	184	24·3	98·0	93·0	0·92	90·5	181	7	3·8	501	12	2·4
Corona 640, 3 oz. ..	99·0	92·7	0·90	92·0	368	2	0·5	1,180	7	0·6	99·3	92·5	1·15	91·5	366	2	0·6	1,597	2	0·1	98·7	94·0	0·70	93·7	375	0	0·0	1,025	0	0·0
Control ..	97·7	90·0	1·04	87·0	174	42	24·1	571	102	17·8	98·7	88·0	1·20	86·0	172	57	33·2	874	219	25·0	98·0	94·0	0·80	94·0	188	6	3·2	521	13	2·5
Corona 640 S, 6 oz. ..	99·3	93·5	0·89	89·7	359	7	2·0	1,135	12	1·1	99·0	89·7	1·03	90·3	361	35	9·7	1,583	121	6·6	95·7	94·7	0·70	94·0	376	1	0·3	1,002	2	0·2
Control ..	97·7	92·0	1·08	88·0	176	16	9·1	571	45	7·9	98·7	90·5	1·25	92·5	185	35	18·9	746	108	14·5	98·0	92·5	0·91	92·5	185	3	1·6	471	4	0·8
Dupont 13, 3 oz. ..	99·3	93·3	0·76	94·7	370	2	0·8	1,165	7	0·6	99·3	92·5	1·08	91·0	364	2	0·5	1,198	5	0·3	97·7	94·3	0·68	93·7	375	0	0·0	893	0	0·0
Control ..	97·7	91·5	1·12	91·5	183	27	14·5	545	61	11·7	98·7	90·0	1·07	87·5	175	48	27·1	726	136	18·8	98·0	93·0	0·90	90·5	181	9	5·0	418	12	2·8
Dupont 30, 3 oz. ..	99·0	93·3	0·87	93·0	372	12	3·2	1,138	33	2·9	99·7	90·5	1·21	92·3	369	17	4·6	1,167	47	3·2	97·0	91·5	0·90	90·5	362	0	0·0	838	0	0·0
Control ..	97·7	93·5	1·00	91·0	188	21	12·5	583	60	10·3	98·7	89·5	0·89	86·5	173	20	20·8	701	113	16·0	98·0	94·0	0·80	93·5	187	6	3·2	404	12	2·9
Semesan dust, 1 oz. ..	98·7	91·5	0·75	91·3	377	1	0·3	1,160	2	0·1	99·7	88·3	1·03	87·3	349	0	0·0	1,386	0	0·0	97·7	94·5	0·60	94·5	378	0	0·0	889	0	0·0
Control ..	97·7	88·0	0·83	88·0	166	28	16·9	528	61	12·2	98·7	88·5	1·12	86·5	173	29	16·1	701	75	10·7	98·0	93·5	0·90	92·5	185	8	4·3	421	19	4·5
Semesan steep, 0·2 per cent. ..	99·7	94·5	0·99	91·5	366	1	0·3	1,108	1	0·1	99·0	89·7	1·38	87·7	351	3	0·9	1,118	10	0·7	97·7	94·0	0·95	93·0	372	0	0·0	915	0	0·0
Control ..	97·7	89·0	1·14	88·0	176	32	18·2	593	86	14·1	98·7	92·0	1·34	92·0	184	35	19·0	750	114	15·2	98·0	89·5	1·06	91·5	183	7	3·8	450	14	3·1
Germisan, 0·25 per cent. ..	97·7	93·3	0·72	93·3	373	2	0·6	1,271	1	0·1	97·7	91·3	0·80	89·7	359	0	0·0	1,338	0	0·0	99·3	94·5	0·68	92·3	369	0	0·0	925	0	0·0
Control ..	97·7	89·0	1·21	89·5	179	40	22·1	629	103	16·4	98·7	89·5	1·15	88·5	177	18	27·2	693	117	21·2	98·0	94·5	1·08	90·0	180	1	0·5	426	1	0·2
Uspulun, 0·25 per cent. ..	99·5	95·5	0·99	93·0	372	1	0·3	1,211	1	0·1	99·3	91·0	1·10	91·0	364	2	0·6	1,419	5	0·3	99·0	93·7	0·61	90·3	361	0	0·0	872	0	0·0
Control ..	97·7	91·0	1·03	92·5	185	12	22·7	648	113	17·4	98·7	91·5	0·95	90·3	181	52	28·0	738	170	23·3	98·0	94·5	1·09	87·5	175	2	1·1	428	2	0·4
Clarke's Protector, 7·7 per cent. ..	82·7	65·7	1·66	65·7	275	0	0·0	1,010	0	0·0	93·3	79·3	1·19	79·0	316	0	0·0	1,376	0	0·0	93·7	88·3	1·07	70·3	281	0	0·0	737	0	0·0
Control ..	97·7	88·5	1·01	88·5	177	33	18·6	641	91	14·2	98·7	92·5	0·82	89·5	179	29	16·2	815	93	11·4	98·0	91·5	1·05	88·0	176	11	6·2	435	17	3·9
Bluestone, 1 per cent. ..	51·7	38·5	1·48	40·5	186	0	0·0	798	0	0·0	84·0	61·0	1·11	60·3	241	0	0·0	1,388	0	0·0	83·0	87·7	1·07	82·5	330	0	0·0	708	0	0·0
Control ..	97·7	91·5	1·20	91·5	183	11	21·0	688	122	17·7	98·7	90·5	1·00	90·0	180	39	21·7	801	135	16·8	98·0	92·0	0·79	90·5	182	11	6·0	456	15	3·3
Bluestone, 2 per cent. ..	31·7	27·0	1·11	29·5	118	0	0·0	727	0	0·0	57·3	45·3	1·55	45·5	191	0	0·0	1,076	0	0·0	69·7	87·7	1·07	75·0	300	0	0·0	782	0	0·0
Control ..	97·7	86·0	1·21	83·0	166	24	17·5	689	88	12·8	98·7	91·0	0·82	91·5	189	37	19·6	750	105	11·0	98·0	91·0	1·11	90·5	181	10	5·5	447	19	4·2
Formalin, 1–320 ..	99·7	69·3	1·31	69·5	278	0	0·0	1,076	0	0·0	97·7	83·7	1·22	85·0	340	0	0·0	1,267	0	0·0	95·3	89·7	1·09	87·5	350	0	0·0	849	0	0·0
Control ..	97·7	81·0	1·08	82·0	166	42	25·4	635	133	21·0	98·7	94·0	0·70	96·0	192	21	10·9	693	61	8·8	98·0	86·0	1·10	87·0	174	13	7·5	422	21	5·0
Formalin, 1–480 ..	97·3	74·3	1·76	76·0	304	0	0·0	1,155	0	0·0	98·0	86·3	1·41	87·3	349	0	0·0	1,240	0	0·0	95·7	89·7	0·90	87·5	350	0	0·0	731	0	0·0
Control ..	97·7	90·5	1·17	90·5	182	17	28·8	659	129	19·3	98·7	92·0	0·70	91·5	183	17	9·3	797	59	7·0	98·0	90·5	0·78	90·0	180	5	2·8	402	8	2·0
Formalin, presoak, 1–320 ..	100·0	82·7	1·52	80·5	322	0	0·0	1,282	0	0·0	99·3	87·5	1·06	85·7	343	0	0·0	1,339	3	0·9	99·3	90·7	0·84	*99·3	271	0	0·0	641	0	0·0
Control ..	97·7	86·0	..	83·5	167	38	22·7	738	131	17·8	98·7	91·0	..	91·5	183	16	8·7	739	53	7·2	98·0	88·0	1·10	88·5	177	10	5·6	465	18	3·9

* Three rows only.

were all harvested in Canterbury in 1925. The Velvet Chaff and College Hunter's varieties were sown 6–10/6/25, the Solid-straw Tuscan 19/8/25. All were dusted (1–750) with spores of *Tilletia Tritici* Wint. collected in 1925 from Solid-straw Tuscan wheat at Ashburton.

The formalin, bluestone, and Clarke's Wheat Protector treatments were done the same day as sown, the other treatments from three to ten days beforehand. First count: Velvet Chaff and College Hunter's, 17/8/25; Tuscan, 16/10/25. Plants finally pulled and counted, 20–26/1/26.

All the field-work was again carried out at the Ashburton Experimental Farm.

FIG. 1 (LEFT). STINKING-SMUT OF WHEAT (TILLETIA TRITICI).

Spore masses in ovaries of wheat inflorescences. Although infected, these heads appear to differ in appearance little from the normal, save that the glumes are forced apart somewhat.

FIG. 2 (RIGHT).

The glumes have here been removed so as to expose infected grains, and these have been sectioned to show the spore masses.

[*Photos by H. Drake.*

THE PROGRESS OF ECONOMIC ENTOMOLOGY IN AUSTRALIA AND NEW ZEALAND.

(Concluded.)

Presidential address to the Biology Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by Dr. R. J. TILLYARD, Cawthron Institute of Scientific Research, Nelson.

II. THE CONTROL OF NOXIOUS WEEDS BY INSECTS.

I TURN now to the second type of problem mentioned at the beginning of the main part of my address—namely, that of control of noxious weeds by their insect enemies. Until quite recently this was almost a virgin field, as the only work that had been done along these lines was the control of lantana in the Hawaiian Islands by means of a lycaenid butterfly and a small fly. These insects attacked the buds and the fruit of the weed, with the result that it was quickly prevented from further spreading; what was already there was grubbed out in very thorough fashion, except in inaccessible places, and the menace is now entirely removed. Those of you who know the hold that lantana has obtained along the east coast of Australia will agree that this achievement was in itself a notable one.

My predecessor in this chair, Professor T. Harvey Johnstone, of Adelaide, gave us for his presidential address at the combined Wellington meeting in 1923 the subject of control of prickly pear by means of its insect and fungus enemies. It is not my intention here to deal with this problem as fully as he did, but it is necessary that I should summarize for you the course of events, and should also bring the account up to date by including the very latest developments. For this purpose I have obtained from the Institute of Science and Industry in Melbourne, through the courtesy of the Director, Sir G. H. Knibbs, a number of advance copies of the new Prickly Pear Bulletin, which gives a full report of the first five years' work of the Board. This report has been supplemented by letters from the retiring officer in charge, Mr. W. B. Alexander, and from the present officer in charge, Mr. L. F. Hitchcock, giving further details of progress made since the report was completed. Thanks to the courtesy of all these gentlemen, I am able to give you an account which brings this remarkable piece of scientific work right up to date.

In the early years of the work, before the method of control by insects was tried out, both chemists and inventors had a try at the problem. Various suggestions were made for the utilization of prickly pear commercially, but they all failed through the enormously high percentage of water in the plant, the small amount and poor quality of the fibre, and the very low fodder value. Then came the idea of a drastic mechanical attack on the pear—*e.g.*, by driving huge tanks at or through it, crushing it into the ground, and automatically ploughing it in at the same time. This was also a failure. The chemists discovered certain arsenical compounds which would destroy the pear at a cost estimated to make the project a commercial success, and a company known as "Cactus Estates, Limited," was

floated to deal with pear-infested land. This company took contracts to clear given areas of land at a quoted price per acre. I believe they lost money on every contract which they took; the cost of dealing with the pear was always higher than the contract price, and in some cases approached very close to the actual value of the land itself per acre. Thus this very laudable effort failed also. Australia was then left in this desperate position: Here was a pest which already occupied an area of land in Queensland and northern New South Wales as big as the whole of Tasmania, and was increasing at the rate of a million acres a year! Unless some remedy were found, in less that a hundred years' time eastern Australia might consist of a wilderness of prickly pear and a series of walled cities fighting for their very existence against it! The vision of this dire calamity approaching was enough to overcome even the prejudice against the use of insect enemies, and so entomologists were sent abroad to all the cactus lands in America to find enemies of the pest and bring them into Australia.

The first point to notice is the method adopted to prevent any possibility of damage being done to plants of economic value by the introduction of these insects. Permits were only granted for introduction into approved research stations, where the insects had to be bred in closed insectaria and cages. At the same time tests were to be carried out with each insect on as many plants of economic value as possible, with a view to finding out whether they would attack anything besides prickly pear. It is interesting to note that out of more than thirty insects introduced not a single one has yet been found which would eat anything else besides prickly pear, while a large number of them will only attack certain species and varieties of the prickly pear, leaving others quite unharmed.

I wish to emphasize the details of this work here, because it has a very important bearing on a problem of the greatest moment to New Zealand—namely, the control of blackberry. As there is to be a separate discussion on the subject of the blackberry pest I will not deal with it fully here.

The second point which I wish to emphasize is one that is often overlooked. Plants and insects have been evolving together for countless ages, and their interactions one with another are very complex, showing all degrees of specialization. The fossil record shows us that these relationships were much the same three million years ago as they are at the present day. In other words, the insects reached the zenith of their evolution long before mankind came on the scene. This condition of equilibrium between plant and insect life can be, and often is, upset by man in pursuit of his own schemes; but it is not generally realized that every change that has been brought about by this means has been actually within the power of man to grant or to withhold. It is only ignorance or lack of care on man's part which gives the insect its opportunity to become a pest. I cannot give a better example of this than the famous case of the gipsy-moth, *Porthetria dispar*. This moth was a native of Central Europe, and was known to have been the cause of serious damage to various forest, orchard, and shade trees, especially in Germany. Nevertheless, because of its fine silken cocoon, which possessed a possible commercial value, it was deliberately introduced into Massachusetts in 1869 by a French

scientist, whose intention was to establish a silk industry with it, using it in captivity only. The moth, however, was allowed to escape through carelessness. Let it be said to his credit that the scientist at once advertised the fact by every means in his power, pointed out the dangerous character of the insect, and implored the State Legislature to take action against it. Entomology "cut no ice" at all, even in America, in 1869, and people took no notice of the warnings. A few years later the good folk of Boston began to notice marked defoliation of their beautiful trees, and it was found that this moth was spreading far and wide, carrying destruction in its wake. In spite of millions of dollars which have been spent in the effort to check the pest it is still spreading, and has recently reached Canada and New York State.

In Europe the gipsy-moth feeds on a variety of trees and shrubs, such as oak, apple, willow, &c., but pines of all kinds are entirely immune from it. In America the same thing occurs. Pines, both native and introduced, are immune, and the moth confines its attention to the introduced hosts on which it originally fed, and to those American species which are closely related to them, such as pin-oak, red-oak, maple, &c. Now, this moth is one of the most generalized feeders known; the female lays its eggs almost anywhere, and at no stage of the life-history does there appear any tendency to restriction of diet. Yet under the new conditions the immunity of pines from attack held good.

The lesson we can learn from this is that in dealing with an insect we are dealing with a stabilized type. If we know its habits under natural conditions we can be fairly sure of its behaviour under any new set of conditions. If we introduced the gipsy-moth into New Zealand we could state with certainty that it would not touch any of our introduced or native pines and taxads, and we could with equal certainty name all the introduced trees which it would attack, and also those native trees which it would most probably attack too.

Nevertheless it is right that we should insist, as biologists, that in every case of the introduction of a plant-feeding insect very thorough experiments should be carried on to determine the exact limits of its feeding-capacity before any attempt is made to utilize such an insect in the open.

Now, to come back to the prickly-pear problem, the method adopted by the Australian scientists in testing their insects is that known as the starvation-test method. It is well known that every organism struggles to go on living, and searches eagerly for the food necessary for it to live. Any insect will attempt to eat unaccustomed food rather than starve to death, if it can possibly do so. A brood of larvæ, therefore, is taken and divided into two equal parts; one of these is put into a cage in which there is a supply of prickly pear, and the other into a cage in which the only food supplied is the plant to be tested—say, pumpkin. The relative behaviour of the two lots of larvæ can then be noted. Both will rest until the time comes for them to feed. Then those on prickly pear will go ahead, while those on the other plant, urged on by an equal desire for food, will wander over the unaccustomed plant searching for their normal food. As hunger increases they must do one of three things: (1) They may feed on the new plant, find it digestible, and continue to feed and grow on it;

(2) they may eat the new plant, find it indigestible, and turn sickly, finally dying of indigestion or starvation; (3) they may absolutely refuse to touch the new plant, dying straight out from starvation.

Other things being equal, it is found that young larvæ are less likely to attack a new plant than older larvæ. The latter, having much stronger jaws, will sometimes, driven by hunger, eat into an unpalatable plant in the vain attempt to obtain sustenance from it before dying of indigestion or starvation; whereas in young larvæ the inherited instinct is usually so strong that they refuse to touch the new plant, even if their jaws are strong enough to gnaw it or to pierce it. In the case of the prickly-pear insects a few of the older larvæ made slight attempts to eat unaccustomed plants, but the effects were very soon visible in the form of severe indigestion, followed by death.

The first insect introduced into Australia was the cochineal insect, *Dactylopius indicus*. This, soon after it was liberated, entirely destroyed some thousands of acres of one species of prickly pear, *Opuntia monacantha*, but was quite ineffective against the commonest pest pear, *Opuntia inermis*, and the other species present in Australia. A search was therefore made for other species of *Dactylopius*, and several of these were introduced and tested. One of these, *D. tomentosus*, showed such good results on *Opuntia inermis* in captivity that it was the first of the new lot of insects to be liberated in 1923. This insect is now doing wonderful work in the field, both in Queensland and New South Wales. The Governor of Queensland, Sir Matthew Nathan, was so impressed with the results in the Blackall district that he suggested that this insect should be distributed by the train-load! A permanent staff is now engaged in packing and distributing this insect to all parts of Queensland where prickly pear exists. There are already numerous places where, instead of the impenetrable thicket of prickly pear that has existed for the past twenty or thirty years or more, the work of this tiny little insect in the course of only a year or so has opened the thicket up sufficiently for men to get through it with ease; in other cases, where the insect has been at work longer, a team of horses can be driven over the ground; and in a few cases the pear has been entirely cleared and the ground put into cultivation.

A curious point about this insect is that it is impossible to predict in what areas it will succeed and in what areas it will fail. Apparently in some places the pear is too tough for its tiny beak to penetrate, and there it fails to do any good. In some areas it attacks the pear equally well both in scrub and in the open, while in other areas it cannot get a start on either. It is generally admitted now, after seeing its work during the last two or three years, that this insect will be one of the main factors in clearing the pear from very large areas in both States.

No other insect has been liberated as yet for so long a time as *Dactylopius tomentosus*. The next most effective species appears to be the red mite, *Tetranychus opuntiae*, which has only been liberated quite recently in three or four areas. A. P. Dodd, who has recently been promoted to the position of officer in charge of the investigations, considers this the most destructive enemy of prickly pear known so far.

The large coreid bug, *Chelinidea tabulata*, which I saw in immense numbers in the cages at Sherwood in 1923, is a most formidable insect which looks at first sight much too dangerous to be liberated in any country. It was tested out, I believe, on no less than seventy-eight plants of economic importance before permission was given to liberate it. It confines itself entirely to the genus *Opuntia*, and increases at an incredible rate. Its attacks make the plants sickly and greatly reduce the amount of fruit produced. Though it is a far more spectacular insect than the cochineal it never seems to produce fatal results. It is now being spread in all directions throughout Queensland, and many of those who have observed its work consider that it will be one of the main factors in the subjugation of the pear.

Two other species of *Chelinidae* and one of *Narnia* were also brought into Australia, but failed to increase in captivity to any extent. They have not been liberated.

Of caterpillars which feed on cactus, species of *Melitara*, *Mimorista*, and *Cactoblastis* have been experimented with. Only two have so far been liberated—namely, *Melitara junctolineella* and *Mimorista flavidissimalis*. The former is spreading rapidly, but its effect in reducing the pear is not very great. The latter increased well at first, but none has so far been seen this summer. One of the latest introductions is the moth, *Cactoblastis cactorum*, from the Argentine. In captivity this has proved much more destructive than any species of *Melitara*, and also it is a much hardier species and easier to breed in confinement. It has increased at a prodigious rate, and liberations are about to begin. Judging by its effect in captivity this insect, when liberated, should rapidly become one of the leading agents in the destruction of the pest.

Some large longicorn beetles of the genus *Moneilema* were introduced, but were found to be difficult to rear in captivity. Later on it was discovered that an egg-parasite had been introduced with them. This insect had to be eliminated and a fresh start made. Up to the present these beetles have not increased sufficiently to enable liberations to be made. The flightless weevil, *Gerstaeckeria basalis*, has also been acclimatized in cages, but not yet liberated. Several other species of beetles have been introduced, but failed to become acclimatized.

It is of special interest to note that, so far, only one enemy has made its appearance in the field, and that is our old friend *Cryptolaemus montrouzieri*, the ladybird beetle which is a well-known enemy of mealy bug. This insect has been attacking the cochineal insects, but, so far as at present can be ascertained, the cochineal increases at a much greater rate than the ladybird, and the latter has had no appreciable effect on it.

In the newly published bulletin on the Natural Enemies of Prickly Pear accounts are also given of a number of fungus diseases and a bacterium which are being experimented with. None of these has so far been liberated. Unlike the insects, the bacterium, *Bacillus cacticidus*, when tested on other economic plants was found to produce a very serious disease in squashes, melons, and marrows. The fungus, *Gloeosporium venetum*, caused a rot to develop in apples within twenty-four hours. Two other species of *Gloeosporium*, one of *Hendersonia*, one of *Macrophoma*, and one of *Macrosporium* have

been tested without causing injury to any economic plants. None of these, however, has as yet been liberated, and it is unlikely that they will play any effective part in the control of the pest in future.

The general opinion at the present time in Australia is that the problem is in course of solution by the utilization of the insect enemies alone. A few years back the then Minister for Lands in New South Wales, visiting the prickly-pear laboratory in the north-west of that State and seeing the work that was beginning there with the insects, remarked that it was the one bright spot in an otherwise hopeless situation. In 1925 the officer in charge of the principal laboratory in Queensland was able to write as follows: "There is now no doubt at all, in our opinion, that in time, by biological means, we shall surely control the prickly-pear pest in Australia."

Prickly pear has laid waste more land than any other pest plant in any part of the world. Its subjugation appeared a hopeless task until the leaders of thought in Australia took courage and decided to utilize the insect enemies to control it. The cost of the work to date has been £40,000, and the total cost before Australia is freed from pear may well amount up to £100,000. The area of land infected is approaching thirty million acres, and is increasing at the rate of one million acres a year. Even if we place a very low average value on this land—say, £10 per acre—there are three hundred million pounds of capital locked up in the infested land and a further ten million pounds' worth going out of action every year. To rescue three hundred million pounds' worth of land in the course of ten or even twenty years at a cost of £100,000 would be a wonderful achievement from whatever angle you may choose to view it, and if it is done by means of the insects, as it appears at present that it will be done, entomologists will be able to claim to their credit one of the greatest triumphs of the human race.

The control of plant pests is one of the outstanding problems of the present day, and one of the most difficult. A plant which to-day is a mere curiosity, of which nobody takes any notice, may in ten years time be a pest, and in twenty years time a menace to the life of a whole community. In Victoria the St. John's wort, *Hypericum perforatum*, has seized and occupied an entire valley of previously fertile country eighty miles in length. In New Zealand and in Australia alike blackberry is spreading at an alarming rate. Who shall say what will be the worst pests of the future! Why should we tolerate any weed in our midst if science can find a simple way of removing it? Therefore I conclude this address by commending to you all the careful study of the problem of control of plant pests by their natural enemies, and appeal to you not to let fear or prejudice sway you in making a decision on so vital a matter. The advance of entomology as an exact science during the past few years has been phenomenal, and our knowledge is now sufficiently sound and wide to justify us in stating that we are capable of undertaking the study of the control of any plant pest by means of its insect enemies without allowing the slightest possible chance of any damage accruing to our country. All we need is the necessary well-equipped laboratories and insectaria, and enough trained entomologists and assistants to do the work required. In the course of a year or two of work in the

insectarium we can discover without any shadow of doubt what any given insect will do if it were to be liberated in New Zealand. Where a safe remedy can be found against any plant pest in the form of an insect which will attack it without touching any other plant, then it would seem to be a clear duty on the part of those responsible for the welfare of the country to accept the decision of its scientists and encourage the work to go forward.

I am well aware that in the case of prickly pear the pest plant was of such a specialized nature that the chances of its insect enemies attacking other plants as well were reduced to a minimum. In the case of blackberry or St. John's wort this would not be so. The scientist's duty then would be to test out all likely insect enemies in the insectarium, to eliminate at once those which attacked other valuable economic plants, and to continue to work with those which would not attack them. In the case of a very serious pest such as blackberry the final result might be a good chance of control, with risk to one or two related plants such as raspberry and loganberry. In such a case if the prospective gain were enormous beside the prospective loss, or if means could be found to prevent the loss, it would be our duty, in my opinion, to press forward with the work and to check the spread of destructive pest weeds over larger and larger areas of this fair country of ours.

FARM DAIRY INSTRUCTION.

THE SYSTEM EXPLAINED.

Dairy Division.

THE growing popularity of the farm dairy instruction system is well demonstrated by the fact that thirty-eight of these Instructors are now operating in various parts of the Dominion. The number of dairy farms under their supervision is over thirty thousand, producing approximately 60 per cent. of the butterfat made into butter and cheese.

Wherever Farm Dairy Instructors have been operating for some time a very decided improvement in the quality of the milk or cream supply has been noticeable. The farmers are quick to recognize the benefits of the advice and assistance given by these officers, and repeatedly, when trouble with the supply arises, send for the Instructor, in order to obtain his help in locating the cause of the difficulty.

In the past the work of farm dairy instruction has been undertaken by the ordinary instructional staff of the Dairy Division, but during the busy season when this work is most effective the Instructors' time is very fully occupied in connection with the factories, &c. Each year, however, a number of dairies have been visited, and assistance and instruction given in the better care of the milk or cream. The conditions found on many of the farms visited have brought home very forcibly the urgent need of more constant supervision, which can only be obtained by the appointment of an officer who is able to devote the whole of his time to this work.

The appointment of a Farm Dairy Instructor entails no very heavy expense to the dairy company or companies concerned. We estimate that one officer can undertake this work in connection with from five hundred to seven hundred farms. A common practice is for a number of dairy companies to combine in order that the requisite number of farms may be available. In districts where the factories are situated fairly close to each other this grouping system can be worked very satisfactorily.

The salary usually paid to Farm Dairy Instructors is £320 per annum, and where five hundred or more farms are under the officer's supervision the Department of Agriculture has assisted the dairy companies to the extent of providing half the salary, or £160 per year. Where the number of farms falls below five hundred the Department has provided a proportionate subsidy. For example, if the Instructor were serving only two hundred and fifty farms the Department's contribution would be £80.

In addition to their proportion of the salary the dairy companies have to find all the Instructor's travelling and locomotion expenses. We estimate these at about £200 per year, and this amount added to that of the officer's salary of £320 gives a total annual expenditure of £520. Deducting the departmental quota of £160, the net cost of a Farm Dairy Instructor's services to each dairy company or group of dairy companies having five hundred or more suppliers would be £360 per year. This must be regarded as a remarkably small expenditure per milk or cream supplier in proportion to the services rendered.

Where a number of factories are grouped together the proportion of each dairy company's contribution to the total expenses is usually worked out on the basis of the amount of butterfat supplied to each company.

Farm Dairy Instructors are appointed by the Department of Agriculture, so that they have official standing. The Department pays the officer's salary in full, the dairy company or group of companies undertaking to repay to the Department each month their due proportion. The companies find directly all expenses of travelling and locomotion. A few companies employing Farm Dairy Instructors have found it convenient to arrange with the officer to provide his own motor-car and travelling-expenses for a lump sum—say, around £200 per annum. Under this system the companies know exactly what the annual expenditure will be It is generally conceded, however, that the best plan in the long-run is for the companies to provide the motor-car and expenses.

In the event of any dairy company or group of companies considering the adoption of this service and desiring advice, arrangements will be gladly made for an officer of the Dairy Division to attend any meeting and give full information or other assistance in furthering the movement.

Efficient drainage is a first essential of economic primary production. Soil-fertility is controlled by drainage. Drainage should be provided, where necessary, to make the utmost use of the latent fertility. Before spending money on lime and manure, attention should first be given to the physical condition of the soil by draining.

HIGHER AGRICULTURAL EDUCATION IN GREAT BRITAIN.

Paper read to the Agriculture Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by W. RIDDET, B.Sc., N.D.A. (Hons.), N.D.D. (Hons.), Professor of Agriculture, Auckland University College.

WHILE university education has been firmly established in Great Britain for many centuries, and the important part played by it in developing the nation has been realized for just as long, it is only within recent times that agricultural science has systematically taken its place in the British university curriculum. Considering that agriculture is one of the oldest arts, and was the main support of the people prior to the industrial revolution, it at first seems strange that no attempt was sooner made to put the art on a scientific basis. The united call of the interested parties had not been made, and naturally the efforts of individuals were unheeded.

However, early in the nineteenth century real earnest attention began to be devoted to agriculture from two distinct sources—firstly, the farmers themselves, and, secondly, scientists interested in agriculture. The former established the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland, bodies which, among other things, interested themselves in the education of the farmer by, in the early stages, offering prizes for essays on agricultural subjects, which were published in their journals, and, later, issuing diplomas to those who satisfied certain examination requirements. Scientists aided the societies by devoting themselves to farming problems which, without fundamental knowledge of science, the farmers could not themselves unravel. The work and teachings of men such as Davy, Liebig, Lawes, and Gilbert comparatively soon became widespread. The activity of the farmers' organizations and of the scientists kindled a flame of enthusiasm which, as it grew in intensity, was reflected in the extension of investigation of agricultural problems, the establishment of agricultural colleges, and, later, the creation of university agricultural departments. The Cirencester Agricultural College was established in 1845. This and the Chair of Agriculture at Edinburgh University established in the eighteenth century (1789) were the only centres of agricultural teaching till near the close of the nineteenth century, when various other colleges were established.

Between the opening of the present century and the beginning of the Great War additional colleges and university departments were instituted. Then with the shortage of food-supplies the enthusiasm for education and research became still greater and the need for the moral and financial support of the teacher and research worker more apparent. Thus upon the cessation of hostilities the number of agricultural teachers was increased, new research institutions established, and county farm schools were brought into being. In the reports of all Commissions set up to inquire into methods of mitigating post-war depression in farming special emphasis is laid on the need for the greater extension of agricultural education and research.

PRESENT-DAY INSTITUTIONS AND ORGANIZATIONS.

At the present time higher agricultural education in Great Britain is provided at ten universities and eight agricultural colleges, so spread throughout the country that they each serve the needs of a definite area. In terms of land under cultivation (including pasture and excluding rough grazing) there is one agricultural college for fully 1,750,000 acres. None of these agricultural institutions is so large as many of those found in some other parts of the world. The number of full-time students seldom exceeds three hundred at any one institute; in many cases the number is much less. Those taking degree courses represent possibly no more than a third of the total number, the remainder being diploma and short-course students.

The maintenance of so many similar institutes involves considerable expense, and to some extent the replication of land, buildings, staff, stock, and equipment. With a comparatively limited grant from the national exchequer, the institutes to some extent handicap each other in procuring additional equipment, particularly expensive delicate apparatus, for the development of investigational work. On account of these factors and in the light of American experience it has been suggested that it would be better to reduce the number of existing teaching colleges and provide the others with more accommodation and better equipment. In opposition to this argument it is pointed out that, in addition to the difficulties coincident upon the amalgamation of staff, there would be a break in contact which the colleges have already established with the farming community; there would be a lesser number of research workers and less variety in their efforts, and although the present system is costly the population is great enough to support it.

The administration and organization of the various institutions differ considerably. The agricultural departments are integral parts of the universities, and therefore controlled by their Councils. The colleges, on the other hand, are usually governed by a composite body drawn from all organizations contributing towards their financial support — namely, various County Councils and Education authorities within the limits of the college area, certain farmers' organizations, and the affiliated University Council. It has recently been recommended by a departmental Committee that, *inter alia*, a standing Committee representative of the various teaching and research institutes should co-ordinate all teaching and research work.

The institutions are so organized as to give detailed instruction in each subject associated with agriculture. Thus there are departments of agriculture, agricultural chemistry, agricultural botany, zoology, dairying, bacteriology, economics, veterinary science, engineering, geology, and in some cases horticulture, poultry husbandry, and bee-keeping. Each department is in charge of a professor or principal lecturer, who generally has the assistance of others, each a specialist in one particular branch of the work. Special accommodation and equipment are provided for each department.

With the exception of a few agricultural colleges the institutions are situated in cities, and either form part of the university buildings or are in close proximity to them. They are thus more or less remote from immediate contact with farming, a disadvantage arising from the

establishment of agricultural departments subsequent to the growth of the cities. Such colleges and departments have, however, a farm within reasonable distance of the cities where demonstration and investigational work is carried out. In spite of this the separation of the college from the farm introduces difficulties from both the teaching and the research work point of view. Those colleges not situated in cities are located actually at their farms.

The work of the institutions is not merely confined to teaching. They are also concerned with advisory, research, and extension work. All carry out advisory and routine work for the areas they serve. The various departments generally undertake a certain amount of research work, varying in extent according to the number of staff and time at disposal; field experiments and feeding trials are carried out at the college farms. In addition, in Scotland, Wales, and parts of England the central college or university department, as the case may be, is responsible for all extension work. This system came into being as the result of extension work following upon the establishment of central institutes. The country is divided into college areas, and each institution appoints one or more instructors to each county. The instructor supervises demonstration areas in selected parts of the country, carries out local field trials, gives advice to farmers, and conducts short courses in agriculture (generally in the evening) at selected centres, so that each farmer may keep in contact with him. By this method the county instructor keeps in close touch with the farmer on the one hand and recent developments in the central college on the other.

Extension work in other parts of England is carried out by organizers appointed by the County Councils. These operate in the same way as the instructors already referred to, but they are not directly responsible to any central college. A recent development has been the appointment of advisory officers to nearly all institutes. These men really act in the dual capacity of local research workers and special advisers. A certain number is attached to each institute, and they each specialize in a branch which is of particular local interest. Problems which fall beyond the scope of the county organizer are referred by him to the advisory officer, who has the necessary accommodation and equipment for their solution. In this way the college can continue teaching as well as its original investigational work, while the county organizer advises the farmer and the advisory officer deals with local troubles as they arise.

In addition to these agricultural teaching institutions there are ten institutions, each under an independent governing body, devoted entirely to research work. Practically all teaching and investigational work in Britain is carried out by the universities, agricultural colleges, and research institutes.

The direct influence which this higher agricultural training has had on British agriculture can scarcely be stated in figures. There is no doubt that it has benefited every farmer by the improvement in varieties of crops, better seed, better grass-mixtures, balanced manures, improved methods of feeding, and in various other ways. Not every farmer had a college training, nor even attended extension lectures; yet all have benefited through the better seeds, fertilizers, and foods on the market, the example of the most progressive in their district,

or even talks with friends whose information may be many-handed. A recent striking example of what can be done is the greatly increased returns and economies effected from the systematic rationing of dairy cows within the past four years. Milk-records have been greatly increased and costs of production decreased. This has been brought about in three successive steps: (1) By patient research work into the actual requirements for milk-production and the value of the various elements; (2) the application of this fundamental research to practice; and (3) the spread of the knowledge so ascertained. Without the fundamental work the extension efforts would have lacked accuracy and possibly created lack of confidence. Without extension work the usefulness of the fundamental success would have been lost.

COURSES OFFERED AT THE INSTITUTIONS.

Courses are designed to meet the varying need of students. Some intend to fit themselves as general agricultural advisers and organizers; a few prefer to select some particular branch of the subject in which they specialize, with the object of later taking up research work; many take a long course at a college to better prepare themselves as farmers or estate agents; and others merely desire a short farmer's course to familiarize themselves with the elements of agricultural science. Thus four types of courses are pre-eminently required. The first two (the general adviser and the specialist) take a full degree course; the third may either take the degree course or simply the shorter diploma one; the fourth takes a short applied course.

In all cases an attempt is made to teach the subject in accordance with its component parts, as an art, a science, and a business. The extent of study in any one of these particular branches is determined by the nature of the course pursued. The future adviser is acquainted with the best art of performing all operations, and has a sound fundamental knowledge of all sciences related to agriculture and their application to farming, together with a good training in the economics of the business. The specialist gets a broad training in the art of agriculture and the business of farming, while he studies in greater detail than the adviser the special branch he later expects to follow. The diploma student is familiarized with the principles underlying all operations and methods without being required to undertake detailed laboratory technique beyond that essentially required in the study of the fundamental sciences, and his attention is especially directed towards improved farming methods and farm-management. The short-course student is taught the principles of agricultural science in a popular way; the most approved practices are brought to his notice, and he is given an opportunity of studying many useful aspects of his business, such as machinery, surveying, book-keeping, and veterinary hygiene, which under ordinary farming-conditions are beyond his opportunity of learning.

No matter which course is taken, a sound practical training is insisted upon. The minimum requirement is twelve continuous months' residence and work on a farm, which work must meet with the approval of the director of the school of agriculture. In some cases this work must be performed before entering upon the course, in others before studying the applied subjects. Students are examined in their farming

experience orally and, if considered advisable, practically. No attempt is made to teach practical agriculture at the college farm, as this would upset experimental work, and it is considered that not only can the student get more practice working as an ordinary farm hand, but he is also made more familiar with the actual conditions with which the farmer has to contend. This aspect is particularly important for those later intending to be organizers and farmers. Different methods of performing operations are carefully explained and compared in the class, and, where necessary, demonstration is given. Any desiring practical instruction can get this at the County Farm Institute.

Those intending to take degree courses are required to pass the same university matriculation examination as other science students. No entrance examination is required of diploma or short-course students, though a minimum age-limit of seventeen years is generally insisted upon.

Degree Course.

Two agricultural degrees are granted by most universities—namely, Bachelor of Science in Agriculture and Bachelor of Science in Agriculture with Honours. The honours degree was introduced within the last two years to meet the needs of students intending to take up research work. Thus those who later intend to seek positions as agricultural organizers or to follow out farming for themselves take the ordinary course, while those who prefer to take up specialized work or aim at teaching in central institutes study for the honours degree. The former necessitates a course of from three to four years, and the latter at least four years. In both cases an additional year's residence on a farm is generally insisted upon.

Though fundamentally alike, the curricula of the various colleges and universities vary somewhat in detail. Generally, both pass and honours students take the ordinary university classes in chemistry, botany, zoology, physics, geology, and economics during their first and second years' study. Thereafter they continue their study in the agricultural department of the university, or, if that is not available, at some agricultural college affiliated to the university first attended. The subjects taken at this stage include agriculture and dairying, agricultural chemistry, agricultural botany, agricultural bacteriology, engineering and land-surveying, agricultural accountancy and economics, veterinary science and agricultural zoology. While all branches of farming are covered by the general term "agriculture," the subject for teaching and examination purposes is divided into field husbandry, animal husbandry, dairying, and farm-management. Students following out the ordinary degree take all these subjects, while those taking the honours degree are required to select one principal subject from among the number and study this in its greatest detail, along with two specified subsidiary subjects chosen so as to be cognate to the principal one. The principal subject must be studied for at least two years at the advanced stage, and a thesis on some aspect must be submitted.

The scope of study is so wide that students need to devote their whole time (apart from vacation) to the work. As already mentioned, no time is devoted at the college by students to farm-work, though

naturally all methods of performing operations are described and demonstrations given where necessary, practical instruction is given in live-stock selection, and frequent excursions are made to well-conducted farms.

Diploma Course.

The diploma course usually covers two or three years. The subjects studied during this course are the same as those for the pass degree, but less time is devoted to detailed laboratory technique. In this case the fundamental sciences are taught at the agricultural college, the students taking their whole course there. Special regulations are usually provided whereby those who have completed the diploma course can, if they so desire, proceed to the degree course without again taking certain applied classes. Such students must, however, submit themselves to degree examinations in all subjects.

Short Course.

The farmers' short course generally extends over the six winter months (October–March). The subjects dealt with include agriculture in all its phases, book-keeping, veterinary hygiene, farm engineering and surveying, farm dairying, and the elements of botany and chemistry. All of these subjects are treated in a popular manner, so that the student gets some insight into the principles underlying agricultural practices and the latest information applicable to general farming.

POST-GRADUATE STUDY AND SCHOLARSHIPS.

In addition to these systematic courses, facilities also exist for post-graduate study. Such study can, if desired, lead to the degrees of Ph.D. and D.Sc. (Agr.). To enable students to undertake post-graduate study scholarships are provided by some universities. This work is of a specialized nature, and is carried out under the direction of the head of a particular department in accordance with the requirements of the scholarship.

While the scholarships are mainly endowments, the Ministry of Agriculture has offered several annually for the past few years. The latter are devoted not only to research work, but also to the training in some special direction of those intending to be county organizers. These scholarships are tenable at any university, and in some cases make provision for one year's study abroad.

Another recent development is the provision by the Ministry of Agriculture and the Development Commissioners of travelling scholarships to enable research workers and teachers in institutes to visit foreign countries and investigate special aspects of any branch of agricultural science. These scholarships are very highly appreciated, as they provide a means of establishing international interest in agricultural problems and discussing methods and results with co-workers in other countries. More useful and greater progress can thereby be made than by the mere perusal of publications. Besides, the visits permit of study being made of commercial practices in these foreign countries which, with adaptations, can often be applied with advantage at home.

OTHER ASPECTS.

Although the total number of openings for graduates in agricultural science is more limited than for those in pure science, in proportion to the number seeking appointments agricultural graduates are just as fortunate as others. Some are appointed to the teaching staffs of colleges and university agricultural departments; some receive appointments at farm institutes and as assistant county organizers; several become technical advisers and analysts to commercial firms; an increasing number is absorbed by research institutes, which have of recent years been considerably increased; the Government departments provide employment for a certain number annually; the agricultural departments of the Crown Colonies provide several annual vacancies; and many return to farming.

So far agriculture has not been systematically taught in day schools, yet at least one county has recently made a departure in this direction, confining instruction to secondary classes, and I believe that the tendency is for this practice to increase.

As regards one of the most important aspects of agricultural education—namely, the total cost—this could scarcely be estimated without inquiring of each institution. Apart from Government grants, revenue is derived from university and college endowments, County Councils, and other public bodies. In addition some of the research institutes have been established by endowment or public subscription augmented by Government grant on a fifty-fifty basis, and are to some extent self-supporting.

Government grants are derived partly from the Ministry of Agriculture and partly from the Development Commission. From the available information it is not possible to distinguish between grants awarded separately to education and research, nor to higher education as opposed to extension work. However, it is worthy of note that the total Government grant for agricultural education and research at present is £700,000 per annum. £200,000 of this amount represents an annual allowance granted for five years on the repeal of the Agriculture Act of 1920. A further £100,000 represents an additional sum granted to augment this amount. In terms of land under cultivation (including pasture, excluding rough grazing) this sum represents £1 per 45½ acres.

If to this sum be added the expense borne by County Councils, endowments, and the like, it will be realized that considerable effort is being concentrated on the scientific improvement of agriculture in Great Britain, although agriculture as an industry is there subsidiary to others as a source of national wealth. In spite of the substantial amount granted it is found that all is needed; indeed, the work of some institutes is restrained for lack of funds.

Superphosphate, in which the phosphate is immediately available when applied to the soil, is particularly valuable in dry climates and on light soils. Slowly available phosphates, such as basic slag and raw ground rock phosphate, are valuable on sour soils and where the rainfall is high. For root-crop growing a mixture of rapid and slowly acting phosphates promotes maximum production.

LIMING AND TOP-DRESSING OF PASTURE AT WINTON EXPERIMENTAL AREA.

RESULTS FOR 1925.

R. McGILLIVRAY, F.L.S., Fields Division, Invercargill.

THE top-dressing of pastures in Southland is a matter of vital importance to the farmers of the province, and the continuation of these experiments at Winton Experimental Area has aroused considerable interest. Many discussions have taken place from time to time as to the kind or combination of fertilizers that should be used to obtain the best results. The answer can only be obtained by means of field tests, and it is for this reason that work of the kind here recorded has been undertaken. The fact that some of the phosphatic fertilizers which have been used have given meagre and tardy results is beyond dispute, but in nearly all cases where suitable mixtures have been used the results have been quite beyond expectations.

The 5-acre pasture block (No. 3) on which the investigation has been carried out was sown in 1920, the seeding per acre being as follows: 40 lb. perennial rye-grass, 6 lb. Italian rye-grass, 2 lb. white clover, and 3 lb. red clover. In 1924 the block was set aside for a top-dressing experiment to test Belgian basic slag against Nauru rock phosphate, each fertilizer being applied at the rate of 3 cwt. per acre across the limed subdivisions as shown on the accompanying plan (next page). Particulars of the first year's results were published in the *Journal* for August, 1925, page 107.

The fertilizers for the second year's tests were applied during July, 1925, at the same rate and in similar manner as in the preceding year. The block was closed up on 1st November for the purpose of ascertaining results. The weighing and collecting of samples was carried out on 1st December in the same way, except that in 1924 only fifty weighings were taken, while in 1925 one hundred were made, as shown on plan. The area weighed for each plot was $\frac{1}{2}$ chain by 4 ft. in width; all weights are again given in ounces. Results are shown in the plan.

In weighing the plots the method adopted was as follows: A two-horse mower was used, and a start was made by cutting a length on the outside of Plot 1A. This was continued with each plot until 1E was completed. A similar weighing was then made in the same plot from A to E, but this time each area cut was along the inside next to the control Plot No. 2. The work was continued in this manner until the completion of Plot 10E. Each area cut was weighed within a period of five minutes, and all samples were taken at the same time.

A botanical analysis was made from representative samples from each series of treatments—not of each individual plot as was done last year. The herbage was much further advanced in growth than was the case at time of weighing on the previous occasion. No very marked difference was found in dry-weight determinations, except

that Plots 2C, 4C, 7C, and 9C showed a greater loss of weight in the drying process than did the herbage from any of the other subdivisions. The basic-slag plots greatly increased their lead of the preceding year over Nauru rock phosphate, and from October onward the slag plots could be picked out from a considerable distance owing to their more abundant growth and the characteristic sheen of the grass. The clover content was also considerably higher and far more robust in growth than in the Nauru plots. Another fact worth noting is that the clovers made a better showing in 1925 on the carbonate-of-lime plots than they did on the plots treated with burnt lime. It is evident that the burnt lime is about exhausted, and that further supplies are required.

	1·8 Tons Carbonate of Lime. A.	3·6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	
Plot 1 ..	736	784	502	672	640	6,678	Basic slag.
	768	784	512	704	576		
Plot 2 ..	502	576	412	506	352	4,746	Control.
	512	544	460	530	352		
Plot 3 ..	736	888	612	672	576	6,894	Basic slag.
	688	832	602	696	592		
Plot 4 ..	352	600	404	544	380	4,573	Control.
	376	616	382	528	391		
Plot 5 ..	648	815	608	704	584	6,724	Basic slag.
	672	840	596	736	520		
Plot 6 ..	368	512	516	506	336	4,350	Nauru rock phosphate.
	336	496	496	480	304		
Plot 7 ..	380	436	417	420	352	4,057	Control.
	364	452	436	436	364		
Plot 8 ..	328	536	500	530	336	4,344	Nauru rock phosphate.
	336	496	490	496	296		
Plot 9 ..	316	438	432	436	340	3,983	Control.
	336	460	418	461	346		
Plot 10 ..	320	410	448	442	361	4,004	Nauru rock phosphate.
	361	466	408	471	317		

DIAGRAMMATIC PLAN OF THE EXPERIMENTAL BLOCK, SHOWING LIMING AND TOP-DRESSING RESULTS FOR 1925.

The figures given on the plots represent green weights of herbage.

In the following table are set out the average green weights of the manured and control subdivisions under various lime treatments :—

			Oz.
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. basic slag	708·0
,,	B :	3·6 tons carbonate of lime plus 3 cwt. basic slag	824·0
.	C :	No lime ; 3 cwt. basic slag	572·0
.	D :	2 tons burnt lime plus 3 cwt. basic slag..	697·3
,,	E :	1 ton burnt lime plus 3 cwt. basic slag	581·3
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	341·5
..	B :	3·6 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	486·0
.	C :	No lime ; 3 cwt. Nauru phosphate	476·3
.	D :	2 tons burnt lime plus 3 cwt. Nauru phosphate	487·5
,,	E :	1 ton burnt lime plus 3 cwt. Nauru phosphate	325·0
Subdivision	A :	1·8 tons carbonate of lime—control	392·2
.	B :	3·6 tons carbonate of lime—control	512·2
.	C :	No lime—control	420·1
,,	D :	2 tons burnt lime—control	482·6
..	E :	1 ton burnt lime—control	359·6

Now that we have the results of two years as a guide the value of basic slag as a top-dressing at Winton is evident. In 1924 slag gave an increase of about 11 per cent. over Nauru rock phosphate, but it was expected that Nauru would make up some leeway this year. The reverse has been the case, however; the slag has increased its lead very considerably, and in 1925 shows an increase of approximately 60 per cent. over Nauru rock phosphate.

Expressed in ounces, the three basic-slag plots gave 20,296, while the three Nauru phosphate plots gave only 12,698, which is very little more than the weights of the three immediate controls. The basic-slag plots have certainly had the advantage of more added fertility than the Nauru plots, for the reason that the sheep frequent the basic-slag portion of the block to a far greater extent than they do the Nauru plots. This preference has been most noticeable during the past season.

FIG. 1. EWES AND LAMBS (145 ALL COUNTED) GRAZING ON BLOCK 3, WINTON EXPERIMENTAL AREA.

BOTANICAL ANALYSIS.

The following table shows the results of a botanical analysis of the hay from each subdivision of the block. The determinations were based on weights, and to fully understand the table the reader should consult the plan of the block.

Plots.	Grasses.	Clovers.	Other Plants (Weeds).	Plots.	Grasses.	Clovers.	Other Plants (Weeds).
	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.	Per Cent.
1A, 3A, 5A ..	78·20	16·80	5·00	6D, 8D, 10D ..	82·90	10·14	6·96
1B, 3B, 5B ..	78·16	16·84	5·00	6E, 8E, 10E ..	82·82	10·08	7·10
1C, 3C, 5C ..	83·20	10·10	6·70	2A, 4A, 7A, 9A ..	86·00	8·00	6·00
1D, 3D, 5D ..	79·96	14·84	5·20	2B, 4B, 7B, 9B ..	83·96	9·00	7·04
1E, 3E, E5 ..	79·93	14·06	6·01	2C, 4C, 7C, 9C ..	85·40	7·40	7·20
6A, 8A, 10A ..	81·57	12·00	6·43	2D, 4D, 7D, 9D ..	83·86	9·22	6·92
6B, 8B, 10B ..	81·40	12·18	6·42	2E, 4E, 7E, 9E ..	83·80	9·00	7·20
6C, 8C, 10C ..	83·34	9·66	7·00				

FIG. 2. TOP-DRESSED FIELD AT WINTON EXPERIMENTAL AREA.
Has been grazed continuously. Alsike and white clover very prominent.

"During the next twenty years, either consciously or unconsciously, the United States will adopt fairly definite policies as to industry and agriculture. We are approaching that period which comes in the life of every nation when we must determine whether we shall strive for a well-rounded, self-sustaining national life in which there shall be a fair balance between industry and agriculture, or whether, as have so many nations in the past, we shall sacrifice our agriculture for the building of cities."—*H. C. Wallace, Secretary of Agriculture, U.S.A.*

A NATIONAL BOTANICAL GARDEN FOR NEW ZEALAND.

PROPOSAL BY INSTITUTE OF HORTICULTURE.

At the midsummer conference of the New Zealand Institute of Horticulture, held at Dunedin in January last, the Hon. G. M. Thomson, M.L.C., moved the adoption of the following remit which had been forwarded by the Dunedin Horticultural Society: "That it is desirable that a New Zealand national botanical garden be established."

Mr. Thomson said that the primary object of such a garden would be to collect and cultivate as large a collection as possible of the plants of the whole world, particularly those remarkable for the beauty of their flowers, foliage, and form, and also those which were of commercial value. The main consideration, next to finance, was climate. Suitable soils could be found to suit the needs of the various plants, but climate could not be controlled, and its variations could be met only to a limited extent artificially. In a cold climate the plants of warmer regions could be cultivated under glass and by means of artificial heat, but in a warm climate it was impossible to cultivate successfully the plants of a colder region. He continued:—

"Every large centre of population should have its botanical garden as an educational institution for old and young alike, contributing not only to the æsthetic tastes and enjoyment of the people, but furnishing a continual object-lesson to all interested in horticulture and in the beautifying of their own homes and of their home towns. The wise custodian of such a garden will carefully limit his efforts to the production of those effects most suited to the climate and conditions of the locality. The ideal botanical garden of the world is Kew, where plants from all parts of the world are collected together, where every appliance of horticultural skill is employed, and where every one can go and learn at first hand what is known of the possibilities of plant-growth. But the object of the resolution which I desire to commend to your notice to-day is not the formation of such a universal garden. Its aim is to gather together a collection of all the indigenous plants of New Zealand, and is exclusive of all exotic species. The reasons for the establishment of a purely national New Zealand botanical garden are very good and sufficient.

"New Zealand is the most distant from any other land area of the large island areas of the world. In one direction only it comes within about 1,200 miles of Australia, the nearest large land area. Northwards it lies still farther from some small island groups in Melanesia and Polynesia; towards the south it is more than twice as far from the Antarctic Continent, where practically no plant-life exists at the present era; while to the east are thousands of miles of deep ocean. This isolation of New Zealand from all other land surfaces took place long ago—how long I cannot state either in years or in terms of geological age. For, while the flora is more allied to that of the Australian than any other region, the separation of the lands certainly occurred before eastern Australia received its eucalypts or its acacias and other characteristic forms, and also before it received any of its mammals. Similarly

there are Melanesian and Polynesian elements in our flora, and more puzzling than any are the South American and Antarctic elements; but all these imply long periods of isolation. The period which has elapsed has given time for the development of many special types of vegetation.

"It is outside the scope of my resolution to go into this subject; but I may just mention such genera as *Myosotidium* in the Chatham Islands, *Pleurophyllum* and *Stilbocarpa* in the Southern Islands, and *Haastia* on our South Island mountains as examples of plants which must have taken very long periods to develop their peculiar and distinctive characters. Now, it is to study all this interesting and fascinating flora that a national botanical garden should be established. Here every type of native plant should, if possible, be cultivated; many of the problems of development could be studied, not only by cultivation, but by experiment. For example: In the new edition of the 'Manual of the New Zealand Flora' the late Mr. Cheeseman enumerates and describes 1,584 species of flowering-plants. It is quite certain that a considerable number of these so-called species—*e.g.*, of *Veronica*, *Celmisia*, *Epilobium*, &c.—are either mere varietal forms, or are hybrids between well-defined species. It will be possible by artificial crossing to establish what are and what are not specific forms; and it is certain also that by such crossing many new and interesting varieties will be raised, of great value from a horticultural point of view. Such a national garden would become to New Zealand what Kew is to the Empire—a place of reference for all sorts of native plants, and a centre of distribution of desirable forms. The possibilities of usefulness are great, and the opportunity should now be taken of impressing on the Government the advisability of establishing such a garden. The expense would be relatively small, especially at the outset, and the station would soon justify its foundation and continuance.

"The next question is one of location. A national garden should be situated near one of the main centres, preferably near one of the University colleges. In considering this question it is all-important to know the composition of our flora. Of the 1,584 species described in the Manual, 192 (or a little over 12 per cent.) are confined to the North Island and do not extend to the South Island. On the other hand, 536 (or nearly 34 per cent.) are confined to the South Island. This is due to the fact, no doubt, that geologically the South Island is much older than the North, and its vegetation has had much longer time to develop distinct forms and races. Again, 360 species (or nearly 22 per cent.) are only met with at or above an elevation of 2,000 ft. on the mountains. Such mountain-plants are always more or less difficult to cultivate at low levels, and are liable under altered conditions to undergo important modifications. Lastly, 109 species are only found in the outlying islands, and of these about one-half come from the subantarctic islands. This great preponderance of southern and mountain forms rules Auckland out at once. Its climate is too warm for these plants. Christchurch is almost equally out of the running; its climate is too cold in winter, and its hot nor'-westers make it very difficult to keep many plants alive throughout the season. I am looking at the question solely from a botanical and horticultural point of view when I affirm that the national garden should either be in Wellington or Dunedin.

"The mean annual temperature of Wellington is 55·3 deg. F., and the rainfall 48·09 in. on 168·8 days. The corresponding figures for Dunedin are 50·6 deg. F., 36·85 in. on 159·2 days. There is not much to choose between them, but Dunedin has less sunshine and more drizzling rain than Wellington. From a gardener's point of view these are not disadvantages. Wellington suffers much more than Dunedin from high winds and gales, but these can be countered to some extent by suitable breakwinds."

In conclusion, Mr. Thomson stated that Dunedin had the land available for such a purpose as that proposed, and that the 65 acres on the Town Belt, above the Botanic Gardens, controlled by the Domain Board, would suit admirably. The city had also a valuable asset in the number of resident botanical and horticultural enthusiasts, several of whom had collections of native plants, especially the mountain varieties, which were not equalled anywhere outside of Otago. From all these points of view, and eliminating all parochial and sentimental reasons, he thought it must be admitted that Dunedin was the most suitable place for such a national botanical garden.

Mr. J. G. McKenzie (Director of City Reserves, Wellington), in seconding the motion, said that there could be no two opinions regarding the necessity of establishing national botanical gardens.

Dr. C. Chilton (Canterbury College) said that he looked on the matter from a scientific point of view. As a teacher of botany he was aware of the difficulties that existed in obtaining living plants for demonstration purposes. It was necessary to stress that scientific men must be in charge of such a garden as that proposed, and which would also provide openings for trained horticulturists. He would suggest that in addition to one central garden there should also be established subsidiary gardens in the various centres. Reciprocity would thus be established between these centres, which would be of great value to the movement. The famous Dutch naturalist, Dr. Lotsy, when recently in New Zealand, was most enthusiastic over the variety of the Dominion's indigenous flora, which was unequalled in any part of the world, and other countries wanted specimens. The difficulty of supplying these would be eliminated by the establishment of a national botanical garden.

After other discussion, in which Messrs. D. Tannock, H. L. Christie, S. T. Tucker, G. A. Green, and Sir G. Fenwick took part, the motion was carried unanimously, and the matter was referred to the executive of the Institute.

Protein, fat, sugars, and starches are the main nutriments contained in crops. In certain crops the percentage of protein is low—wide ratio feeds; in others high—narrow ratio feeds. The dairy cow when in milk requires narrow ratio feeds. Crops in a young vigorously growing condition are generally rich in protein.

Good top-dressed grassland, well provided with clover, provides ideal and cheap feed for dairy cows during the summer. Early mowing—securing a good aftermath—chain harrowing, moderate-sized paddocks, and phosphate top-dressing are the main factors concerned in dairy pasture management.

EXPERIMENTS ON MANURING OF POTATOES IN CANTERBURY, SEASON 1924-25.

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, B.Sc., B.Ag., Assistant Instructor in Agriculture, Christchurch.

Two experiments in co-operation with farmers on the manuring of potatoes were carried out in Canterbury in the 1924–25 season by the Fields Division.

EXPERIMENT 1: ON FARM OF L. C. BANKS, COUTTS ISLAND, EYRE COUNTY.

Sowing was done on 24th October, 1924; weighings were made on 8th and 9th May, 1925.

Previous crops had been as follows: 1923–24, peas; 1922–23, oats; 1921–22, oats.

The manures used for the experiment were applied in the following order:—

	Quantity per Acre.
(1.) Superphosphate (high grade)	3 cwt.
(2.) Control (no manure).	
(3.) Super and steamed bonedust in equal parts by weight	3 cwt.
(4.) No. 3 mixture, plus sulphate of potash at ¾ cwt. per acre	3¾ cwt.
(5.) Control.	
(6.) No. 4 mixture, plus sulphate of ammonia at ¾ cwt. per acre	4½ cwt.

Each treatment contained five rows of potatoes, the rows being 30 in. apart and about 5 chains long. The series was repeated four times across the field, and may be referred to as series A, B, C, and D. Series A and C had the manure applied with the potatoes at the time of planting, and series B and D had the manures top-dressed four weeks after planting. Unfortunately, circumstances prevented top-dressing being done earlier, and as this appeared rather late the comparison of the two methods was abandoned. However, the yields from each of the methods of application were treated separately, and, while no strict comparisons have been made between the methods themselves, a study of the figures gives some interesting indications of the different behaviour of the manures under the different methods of application.

METHOD OF PLANTING.

The experiment was sown with an O.K. Champion planter, which had an adjustable manure-feed. As usual, the adjustment required to give the desired rate of sowing of manures was ascertained prior to the plots being sown.

COMPARISONS OF YIELD.

Comparisons have been made by Student's method between six paired plots situated side by side in cases where manurial treatments

are compared with controls. Where manurial treatments are compared with one another twelve pairs of plots have been taken. Manured plots compared were either side by side or separated by a control strip only. The three centre rows were hand-dug, and carefully sorted and weighed, the size of the plots being ½ chain long by three rows wide. The potatoes were sorted by hand into "table," "seed," and "small." A particularly fine sample of the largest size was made, thereby reducing the percentage of table potatoes to below what would be regarded as a good marketable sample. The sorting, however, was very uniform throughout, and the high standard attained places a more searching test on the extent to which the fertilizers pay for their application.

OBSERVATIONS DURING GROWTH.

At the time of the top-dressing of two series (four weeks after sowing) the plants on the already manured plots were appearing through the ground, while on the untreated plots very few tops were visible. The manured plots maintained a marked superiority throughout growth, with a very slightly better appearance of the super plots and those having super, potash, and nitrogen.

EVALUATION OF INCREASES.

For purposes of evaluation, table potatoes are reckoned at £3 per ton, and seed at £1 10s. The small potatoes are disregarded, because it is customary for big growers to leave these lying on the ground. The value of "tables" has been arrived at from the fact that the average price for a number of seasons has been about £4 per ton for May delivery.

Allowing 16s. 6d. per ton (eleven bags at 1s. 6d. per bag) for digging by hand (machine digging would cost less) and 5s. per ton as an average cost of carting, the return per ton of increase would be £2 18s. 6d.—say, £3. The value of seed potatoes varies considerably. Pure seed of a good variety realizes up to £8 per ton, whereas ordinary varieties that cannot be regarded as pure are sometimes difficult to dispose of. An average purchase price for such seed seems to be between £2 10s. and £4 per ton, the price being governed largely by the quality and demand for the particular variety. The lower amount is here taken as a basis for evaluation, and the cost of digging and cartage as for table potatoes deducted, leaving the sum of £1 8s. 6d. per ton—say, £1 10s.

That the figure is extremely low is emphasized by the following: Seconds of grain, discoloured samples, &c., are often used as pig-feed when they are difficult to dispose of. Taking the case of barley, this commodity is often of little value in the open market if at all weathered and discoloured. No farmer would think of selling at, say, 2s. 6d. per bushel, but would do quite well if able to purchase at that figure for pig-foods. Now, the price per ton at 2s. 6d. per bushel would be £5 12s. The starch equivalent of barley is 71. So that one unit of starch equivalent of barley would be approximately 1·6 shillings. If one unit of starch equivalent is worth 1·6 shillings, then potatoes—the starch equivalent of which is about 18—would be worth $1{\cdot}6 \times 18 = 28{\cdot}8$ shillings, or approximately 29s. per ton. In

FIG. 1. SOME OF THE EXPERIMENTAL ROWS IN THE GROWING POTATO CROP ON MR. BANKS'S FARM.

On left, complete manure; on right, control (untreated).

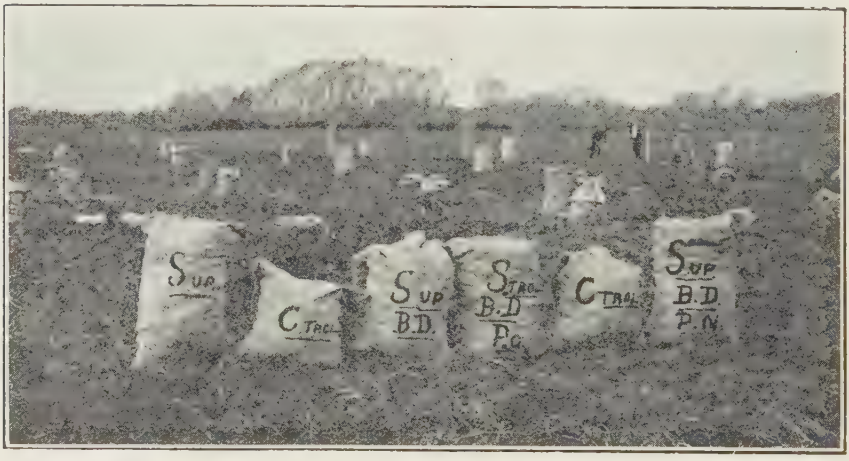

FIG. 2. SHOWING COMPARATIVE YIELDS FROM EQUAL AREAS UNDER THE DIFFERENT TREATMENTS.

Left to right: (1) super; (2) control; (3) super and bonedust; (4) super, bonedust, and sulphate of potash; (5) control; (6) super, bonedust, sulphate of potash, and sulphate of ammonia (complete manure).

addition, the manurial value of potatoes is about 5s. per ton, so that if the farmer regards barley at 2s. 6d. per bushel as a profitable pig-food, then potatoes at 29s. per ton (disregarding the manurial value) will be equally profitable. This fact should be sufficient argument against the practice of allowing small potatoes to lie on the ground and rot.

Table 1.—Series A and C, Manure with Seed: Yields of Manured Plots compared with Controls.

Treatment.	Number of Paired Plots.	Grade.	Yield in Tons per Acre.			Odds.
			Treatment.	Control.	Difference in Favour of Treatment.	
(1.) Super ..	6	**Total**	12·74	8·67	4·07	4,999
		Table	6·64	4·11	2·53	2,499
		Seed	4·01	3·21	0·80	1,249
		Small	2·09	1·35	0·74	..
(3.) Super plus bonedust	6	**Total**	11·52	8·67	2·85	2,499
		Table	5·76	4·11	1·65	4,999
		Seed	3·95	3·21	0·74	243
		Small	1·81	1·35	0·46	..
(4.) Super plus bonedust and potash	6	**Total**	10·92	8·59	2·33	1,666
		Table	5·64	4·40	1·24	587
		Seed	3·56	3·02	0·54	768
		Small	1·72	1·17	0·55	..
(6.) Super plus bonedust, potash, and sulphate of ammonia	6	**Total**	13·38	8·59	4·79	4,999
		Table	7·66	4·40	3·26	1,428
		Seed	3·90	3·02	0·88	768
		Small	1·82	1·17	0·65	..

NOTE: Comparison of yields of small potatoes not treated statistically.

COMMENTS ON TABLE I.

(1.) Super *versus* control: The application of 3 cwt. of super has resulted in a total increase of approximately 4 tons per acre, 2½ tons of which are table potatoes and almost 1 ton seed, the remainder being small. The phosphate has caused an increase in the percentage of table potatoes, with a decrease in the percentage of seed. Allowing £3 and 30s. as the net value per ton of the increased portion of table and seed respectively, and deducting the cost of manure (super, 42/44, £7 5s. per ton; steamed bonedust, £12 10s.; sulphate of potash, £19; sulphate of ammonia, £22) per acre, the increase in monetary return due to the use of manure is £7 14s. per acre.

(3.) Super and bonedust *versus* control: Here again the yield is considerable, but results in a monetary increase of only £4 11s. 6d. per acre.

(4.) Super, bonedust, and potash *versus* control: The fertilizer mixture in this case is more expensive, and the net value of the increase of 1¼ tons of table and ½ ton of seed is considerably lessened, being only £2 7s. The percentages of table are the same in both cases, but the increase in the percentage of small on the manured plots is an

undesirable feature, and must be attributed to the effect of potash, as no such effects occurred when mixed phosphates only were used.

(6.) Super, bonedust, potash, and sulphate of ammonia *versus* control: The complete mixture of artificials, although the most expensive of the treatments, yields an increase the net value of which is £8 2s. per acre.

Table 2.—Series B and D, Manures top-dressed: Yields of Manured Plots compared with Controls.

Treatment.	Number of Paired Plots.	Grade.	Yield in Tons per Acre.			Odds.
			Treatment.	Control.	Difference in Favour of Treatment.	
(1.) Super ..	6	**Total**	11·67	9·15	2·52	832
		Table	6·86	4·99	1·87	302
		Seed	3·23	2·83	0·40	51
		Small	1·58	1·33	0·25	..
(3.) Super plus bonedust	6	**Total**	11·16	9·15	2·01	4,999
		Table	5·96	4·99	0·97	76
		Seed	3·63	2·83	0·80	999
		Small	1·57	1·33	0·24	..
(4.) Super plus bonedust and potash	6	**Total**	10·93	8·37	2·56	9,999
		Table	6·82	4·24	2·58	4,999
		Seed	3·05	2·96	0·09	2·8
		Small	1·06	1·17	0·11	..
(6.) Super plus bonedust, potash, and sulphate of ammonia	6	**Total**	10·80	8·37	2·43	1,249
		Table	6·69	4·24	2·45	9,999
		Seed	3·06	2·96	0·10	2·8
		Small	1·05	1·17	0·12	..

NOTE: Comparison of yields of small potatoes not treated statistically.

COMMENTS ON TABLE 2.

(1.) Super *versus* control: The super increase of 1·87 tons of table and 0·4 tons of seed gives a profit of £5 2s. 6d.

(3.) Super and bonedust *versus* control: The manure here shows a profit of £2 12s. 6d. per acre.

(4.) Super, bonedust, and potash *versus* control: The remarkable feature of this comparison is that the increase in the yield of table potatoes is equal to the total increase, and the percentage of increase is nearly 12. The decrease in the percentage of seed and small is highly significant. This result must be attributed to the potash when applied as a top-dressing some time after the potatoes are sown, and is totally different from the result of the application of potash with the seed. The net profit is £5 13s. 6d. per acre.

(6.) Super, bonedust, potash, and sulphate of ammonia: The complete mixture has behaved in an almost similar way, and the direct comparison of the fertilizers points to the value of potash when top-dressed. The sulphate of ammonia applied in this way appears to have a totally different effect from that got by application with the seed. The profit of this mixture is £4 9s. 6d. per acre.

COMMENTS ON MANURES COMPARED WITH ONE ANOTHER.

Manure with Seed.

Super *versus* super and bonedust: The superiority of super over the mixed phosphates is highly significant, the table potatoes alone being nearly 1 ton per acre better.

Mixed phosphates and potash *versus* mixed phosphates: The addition of potash to mixed phosphates has caused a depression in yield of 0·6 ton. Attention is here drawn to the fact that potash is often found to have a depressing effect on yield.

Mixed phosphates, potash, and sulphate of ammonia: This treatment showed a total increase of 2·19 tons per acre over potash and mixed phosphates. This very considerable increase is undoubtedly due to the sulphate of ammonia, and since this costs only 16s. 6d. per acre the result is highly paying.

Manure top-dressed.

Super *versus* super and bonedust: There is no difference between yields of these treatments, though the former shows a slightly lower percentage of small potatoes.

Mixed phosphates and potash *versus* mixed phosphates: Although there is no marked difference in the total yield, the potash has had a very marked effect on the table grade, increasing the yield by nearly 1 ton per acre. The reduction in the amount of smaller kinds is considerable, and this behaviour of potash when used as a top-dressing is important. The increase in yield of "tables" gives ample justification for its application in this way. The work of the present season is designed to further test the behaviour of potash under the different methods of application.

Mixed phosphates and potash *versus* complete mixture: It would appear that sulphate of ammonia when applied as a top-dressing is of little use. This should be compared with the effect of sulphate of ammonia when applied with the seed.

Referring to potatoes, Sir E. J. Russell states in the *Journal of the Ministry of Agriculture* (England), 1925, page 405: "The effect of the nitrogenous dressing depends on the time of application. In all our experiments it has proved better to apply the sulphate of ammonia with the seed rather than to give it later as a top-dressing when the plants are showing through the ground."

(To be continued.)

New Rabbit Districts.—The constituting of the Whangamomona Rabbit District for the purposes of Part III of the Rabbit Nuisance Act, and of the Wanganui Rabbit District under Part II of the Act, were gazetted on 4th March.

A cow producing 300 lb. of butterfat consumes about 20 tons of grass during the year. Adequate feeding at all periods of the year is essential to secure economical production. If grass fails, special crops must be provided.

LIMING AND TOP-DRESSING EXPERIMENTS IN MARLBOROUGH.

OBSERVATIONS FOR 1925–26 SEASON.

(Concluded.)

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

THE KOROMIKO AREA.

THE pasture laid down at Koromiko in the autumn of 1924 was of quite a different nature from that existing at the Spring Creek area. On the flat country of the Sounds district far too little is done in the direction of establishing permanent pastures of English grasses and maintaining such pastures by a correct system of top-dressing with artificial fertilizers. For two reasons it is undesirable to hay such pastures: (1) Because cutting tends to weaken the natural growth of the pasture elements, and (2) because such grasses as cocksfoot and timothy, while excellent grasses in the pasture sward, make much poorer hay than does red clover.

For the purpose, however, of making comparisons in the first two seasons, weighings have been taken from all these plots. It is our intention, however, for the future not to hay the paddock, but simply to stock it and spell it from time to time as the exigencies of farm-management demand. In the early spring of the current year the pasture will be shut up and an analysis of its constituents made; a farmers' field-day will be held, differences noted and photographed, and then the pasture will be stocked again.

As recorded in the account of the preceding season's operations published in the *Journal* for September, 1925, the pasture mixture sown at Koromiko was as follows: 12 lb. cocksfoot, 15 lb. perennial rye-grass, 4 lb. Italian rye-grass, 3 lb. timothy, 4 lb. crested dogstail, 2 lb. white clover, 2 lb. cow-grass; total, 42 lb. per acre. Although the hay cut in the spring of 1924 consisted almost entirely of temporary elements—Italian and perennial rye-grass—the pasture at hay-making-time in 1925 presented a good showing of cocksfoot, timothy, crested dogstail, and red and white clover. The growth of these elements, although now good, was poor until the second season.

The plots were divided into three series: (1) A trial of lime against no lime; (2) a trial of 2 cwt. of superphosphate applied annually, together with 1 ton of carbonate of lime per acre applied periodically (only one dressing so far applied), against 1 ton of lime carbonate per acre alone; (3) a trial of an annual top-dressing of 2 cwt. of super against an annual top-dressing of 2 cwt. of blood-and-bone per acre.

The following table will enable a comparison to be instituted between the two seasons' weights (sixteen to twenty weighings taken from each method of treatment):—

1924–25 Season.		1925–26 Season.	
If control plots are represented by the number 100, then—			
Average of limed plots	111	Average of limed plots	102
Average of super alone	113	Average of super alone	130
Average of super and lime	131	Average of super and lime	149
Average of blood-and-bone	113	Average of blood-and-bone	117

FIG. 1. A NEAR VIEW ON THE KOROMIKO PLOTS.
On left, lime alone; on right, lime and superphosphate.

FIG. 2. GENERAL VIEW ON THE PLOTS AFTER STOCKING.
The dark patches are limed and manured areas closely grazed by the stock; the light parts are untreated control plots where the grass stubble has been left by the stock.

Although the weights do not bear testimony to any beneficial effect from the use of lime alone, at the time the hay-cut was made there was a strong difference in colouring, the limed plots being of a much darker green. The difference between the plots treated with super and lime and those treated with super alone was marked, the clover bottom in the case of the former being much thicker. The weights also show a perceptible superiority over those obtained from the plots treated with super alone. Blood-and-bone, although on the average giving the lowest return of any manure applied, shows a superiority over the untreated plot yield. One must take into consideration, however, that while the cost of the blood-and-bone was 12s. per hundredweight the cost of the superphosphate was 6s. 4½d.

The first accompanying photograph (Fig. 1) shows the difference between the results obtained on the plot treated with super and lime as compared with that treated with lime alone. The second (Fig. 2) was taken after the paddock had been stocked, and shows how the cattle and sheep have left the long grass stubble uneaten on the control plots, but have grazed close to the ground the pasture on the plots treated with lime or manure.

If lime were applied on the Koromiko flat country once in four years the cost would be about 6s. 3d. per annum exclusive of labour. The costs might therefore be compared somewhat as follows: Lime alone, 6s. 3d. per annum; 2 cwt. super alone, 12s. 9d.; 2 cwt. super and lime (once in four years) at 1 ton per acre, 19s.; 2 cwt. blood-and-bone, 24s.

It will thus be seen that super and lime, taking the evidence of weights and costs alone, is less payable than super alone. However, there is considerable reason to think that when a pasture analysis is made this decision will be reversed, as the clover content on the plots treated with super alone is much weaker than that on the plots treated with super and lime.

SALT POISONING IN PIGS.

A RECENT mortality resulting in the deaths of nine pigs in Taranaki, investigated by the Live-stock Division and found due to excess of salt entering the feed, points to the necessity of warning pig-breeders of the extreme susceptibility of the pig to the action of salt. The pigs in question were whey-fed. A specimen of the whey was analysed by the Department's Chemist and found to contain salt to the extent of 2·56 oz. per gallon.

The symptoms shown by pigs affected by ingestion of excess of salt come on suddenly and indicate disturbance of the nervous system. The animals show loss of co-ordination in movement, staggering about, and frequently falling over on the side and struggling. There is also apparent blindness. Eventually complete loss of power occurs in the hind legs, followed by death. *Post mortem* examination reveals inflammation of the lining membrane of the stomach and intestines.

Treatment of affected pigs is practically hopeless. In prevention of the trouble care must be taken to exclude from the swill anything which is likely to contain salt in excessive quantity.

—*Live-stock Division.*

TESTING OF PUREBRED DAIRY COWS.

JANUARY TO MARCH C.O.R. LIST.

W. M. SINGLETON, Director of the Dairy Division.

COMMENCING the records for the new calendar year, 1926, fifty-one cows have been issued certificates in the three months January to March, details being given in the appended list.

The highest performance in the Jersey section is that of Mr. S. Dale's Remarkable Mary, a three-year-old, which has gained a certificate on 742·05 lb. butterfat. This animal already has one C.O.R. to her credit—577·18 lb. in the senior two-year-old class. Remarkable Mary was bred by her present owner, Mr. S. Dale, of Fairlie. Her sire is Remarkable of Meadowbrook, who is in turn sired by Lord Twylish, one of the best-known sires of the breed in New Zealand. On the dam's side Remarkable Mary traces back to K.C.B., Campanile's Sultan, and Starlight, each of which has figured more or less prominently in the building of the breed in New Zealand.

The most remarkable performance among the Friesians here recorded is that of Mr. J. McAnulty's Lady Rosebud, with 794·40 lb. butterfat, in the mature class. This cow was bred by Mr. J. Boag, jun., Brookside, Canterbury. She is the only tested daughter of De Kol's Duke, who is a son of Commodore de Kol, with three 600 lb. C.O.R. daughters to his credit. Commodore de Kol is by Nazli de Kol (ten C.O.R. daughters), who, in turn, is by Sir de Kol Inka

DEWDROP IST OF BROOKSIDE (W. HALL, LEPPERTON).

C.O.R., 1926, in Ayrshire mature class: 9,565 lb. milk, 385·98 lb. butterfat. This worthy representative of the breed is upwards of fifteen years old.

Pietertje (sixteen C.O.R. daughters). The dam of Lady Rosebud is Rosebud 2nd of Kokatau, whose dam, Rosebud of Kokatau, has a C.O.R. for 407·77 lb. butterfat. Lady Rosebud traces back to Edinglassie (seven C.O.R. daughters).

An interesting performance recorded is that of Mr. W. Hall's Ayrshire cow Dewdrop 1st of Brookside. The record is noteworthy on account of the age — 15 years 109 days — at which this cow commenced her test. The accompanying photograph is a recent one, and would seem to suggest that Dewdrop is good for several years yet. The constitution which has enabled her to keep going so long is quite apparent, and it is also evident that she is the type of a producer. Dewdrop 1st of Brookside has won many show-ring championships. She has produced some fourteen calves, so that her combination of powers of production and reproduction should make her a valuable foundation cow of the breed.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Queen's Glaxo Lass ..	H. J. Burrell, Bunnythorpe	2 28	243·3	305	8,011·2	521·33
Tirohia Grandiflora ..	B. E. Veale, Tirohia ..	2 53	245·8	364	8,834·25	441·17
Alfalfa Mademoiselle*	J. R. Kelly, Morrinsville ..	2 45	245·0	354	8,211·3	434·43
Magnet's Neat Maiden	H. Doel, Taumarere ..	1 206	240·5	365	7,399·3	410·64
Competitor	F. J. B. Ryburn, Paterangi	2 84	248·9	365	6,348·6	395·21
Beaumont Crystal ..	C. J. Masters, Hunterville	1 298	240·5	364	6,842·4	345·43
Tillingdown Rilette ..	H. O. Washbourn, Richmond	1 338	240·5	365	7,183·4	343·45
Joybank Pride ..	Mrs. A. Henry, Omata ..	2 30	243·5	365	6,643·8	341·64
War Bride of Puketapu	T. H. Western, Bell Block ..	1 352	240·5	219	4,809·9	293·85
Holly Oak Rita ..	T. H. Western, Bell Block ..	1 359	240·5	365	4,956·6	289·18
Woodlands May ..	T. H. Verry, Pahiatua ..	1 336	240·5	251	4,905·5	253·29
Senior Two-year-old.						
Swan's Fox's Fancy ..	Brakenridge and Pearson, Taupaki	2 145	255·0	365	8,985·6	494·06
Creamlands Darkie ..	T. H. Verry, Pahiatua ..	2 100	250·5	262	5,172·9	275·75
Three-year-old.						
Remarkable Mary ..	S. Dale, Fairlie	3 211	298·1	365	11,450·2	742·05
Milly Merit	F. S. Veale, Cambridge ..	3 42	281·2	365	6,692·8	466·04
Four-year-old.						
Ohio Abbess* ..	W. T. Williams, Pukehou ..	4 113	324·8	365	12,144·7	709·41
Maiden's Neatness ..	W. McKenzie, Palmerston N.	4 75	321·0	365	7,891·9	548·72
Mature.						
Waipiko Chloris ..	S. H. Wearing, Richmond	7 70	350·0	361	12,759·0	643·82
Jerseydale's Princess May	J. Pettigrew, Pihama ..	7 26	350·0	365	11,856·6	598·02
Waipiko Morelle ..	R. Waterhouse, Papakura	8 147	350·0	365	8,583·0	556·52
Una's Choice ..	J. B. Clemow, Stratford ..	7 37	350·0	365	9,096·6	543·25
Almadale Pride ..	J. K. Watson, Tatuanui ..	6 89	350·0	365	9,683·2	533·30
Moth of O.K. ..	F. V. Green, Midhirst ..	7 38	350 0	279	7,510·6	411·41
Ivondale Sunshine ..	P. J. Petersen, Brixton ..	6 98	350·0	187	7,454·1	353·89

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.	Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Johanna Pontiac Valdessa*	John Court (Ltd.), Auckland	2 16	242·1	365	17,919·7	635·70
Rosevale Jessica Posch*	H. North and Sons, Omimi	2 47	245·2	365	17,807·0	545·29
Fairmont Lady Grace*	James Hart, Tatuanui ..	2 70	247·5	365	15,289·6	506·07
Rosevale Gipsy Abbekerk Posch*	H. North and Sons, Omimi	2 103	250·8	365	15,409·1	489·25
Bainfield Topsy Bell*	Piri Land Coy., Auckland ..	2 74	247·9	365	13,303·2	420·08
Longbeach Transvaal Princess 2nd†	J. H. Grigg, Longbeach ..	2 102	250·7	301	9,436·8	338·78
Nanette Ormsby ..	W. Barton, Featherston ..	1 333	240·5	306	8,473·5	292·88
Lady Fern Cliff Pontiac Valdessa †	John Court (Ltd.), Auckland	2 10	241·5	337	7,775·3	284·65
Anawhata Dorothy Belle Segis	P. F. Boucher, Kumeu ..	2 4	240·9	349	7,613·1	277·30
Countess Johanna Valdessa Fayne†	John Court (Ltd.), Auckland	2 2	240·7	322	6,911·3	255·75
Junior Three-year-old.						
Cluny Nazli Buttercup*	Piri Land Coy., Auckland ..	3 39	280·9	365	15,360·3	520·81
Junior Four-year-old.						
Glencairn Rose Bud	W. H. Staniland, Clandeboye	4 85	322·0	347	10,556·8	452·99
Mature.						
Lady Rosebud* ..	J. McAnulty, Ashburton ..	9 108	350·0	365	17,017·0	794·40
Rosevale Bertha Posch*	H. North and Sons, Omimi	6 82	350·0	365	18,561·5	610·23
Lady Bountiful Domino*	F. G. Wayne, Parawai ..	7 142	350·0	365	15,253·6	527·73
Wakalona's Jewel ..	Mrs. A. M. Budd, Carterton	9 299	350·0	331	11,437·8	461·38
Ashlea Coral* ..	R. Colee, Greendale ..	6 28	350·0	292	14,938·9	459·35
Topsy Queen Pontiac†	John Court (Ltd.), Auckland	7 37	350·0	365	11,227·2	411·51
Countess Belle Segis†	Waitemata Stud Farm, Hobsonville	6 10	350·0	365	10,630·6	356·64
	AYRSHIRES.					
Four-year-old.						
Duchess of Ivanhoe ..	A. M. Weir, Menzie's Ferry	4 288	342·3	364	11,714·6	431·19
Mature.						
Dewdrop 1st of Brookside	W. Hall, Lepperton ..	15 109	350·0	365	9,565·5	385·98

Second-class Certificates.

	Jerseys.					
Junior Two-year-old.						
Jauns Free.. ..	B. N. and W. A. Sandilands, Feilding	1 325	240·5	365	7,251·1	368·82
Mature.						
Belvedere Maiden's Pride	R. R. Dean, Te Kumi ..	9 29	350·0	365	11,210·2	581·39
	Friesians.					
Junior Two-year-old.						
Hobson Princess Fayne Segis	John Court (Ltd.), Auckland	2 13	241·8	365	16,967·0	583·99
Star Queen.. ..	J. McAnulty, Ashburton ..	1 357	240·5	365	16,938·7	519·83
Westmere Princess ..	Piri Land Coy., Auckland ..	2 58	246·3	365	12,347·1	401·77
	Milking Shorthorns.					
Mature.						
Dominion Gentle of Ruakura	W. H. Simms and Sons (Ltd.), Christchurch	5 364	350·0	365	12,055·5	489·30

SEASONAL NOTES.

THE FARM.

WHEAT-GROWING IN CANTERBURY.

It is now becoming generally recognized that wheat is an important crop in the best rotations for the stronger Canterbury soils. Were it not for wheat-growing much short-rotation grassland which is now broken up and brought into profit by growing rape and young grass would be left for years as unproductive, patchy, and run-out lea. Once land is worked up, a succession of crops can be taken with comparatively little cost of cultivation, and the wheat crop helps to pay for the putting-in of the plough.

Place in rotation: Wheat after peas, oats and tares, or clover is the ideal, but wheat following rape is good practice, especially where the rape crop follows lea. The roots of the rape will disintegrate the turf at the bottom of the furrow, and, the soil being further enriched by droppings, the conditions are ideal for the wheat-plant. Last year saw many profitable wheat crops sown late on the potato lands; but late sowings are very uncertain, as the rooting-system is not sufficiently developed to enable the plant to withstand drought. Wheat after wheat or oats pays, because the second crop can be obtained with a minimum of cultivation; but even on strong soils the number of wheat crops that can be taken in succession is very limited, and a second crop should be well supplied with manure. Wheat grown after lea is generally rather subject to grass-grub attack, and it is the best principle to take a preliminary rape crop. If, however, wheat is to be grown, the lea should be skimmed early and the skimming worked down. If the grass is wanted till late on in the season a good quick substitute for skimming is to thoroughly tear up the turf with the disks and cultivate before ploughing. This turning to the bottom of 2 in. or 3 in. of well-worked soil ensures that the furrow is worked to its full depth; the plants' roots thus have a widened range, and, more important still, there is a good connection with the subsoil reserves of moisture.

Manuring: In spite of the fact that phosphate manuring pays with certainty on most Canterbury soils, the neglect to apply such fertilizers is all too common. An amount of 1 cwt. per acre of superphosphate or basic super sown with the seed gives the plant a good start, and increases the rooting-system during the early part of its life, so that it is able to grow satisfactorily in the drier months preceding harvest. Nitrate of soda at 1 cwt. per acre, top-dressed in the spring, should pay with wheat after wheat, especially if a wet winter has caused leaching of nitrates from the soil. The Department of Agriculture is conducting trials along these lines, and reliable information will be given at a later date.

Seed: Machine-dressing of wheat is a paying proposition, for not only is the part taken out valuable as fowl-wheat, but sowing broken grains is absolute waste. Many of the small shrivelled seeds sown

are harmful in that they produce weakly plants, which rob their more robust neighbours yet never come to maturity. Plants produced from large plump grains are less likely to be attacked by fungoid diseases. Finally, weed-seeds are removed by screening.

Sowing: Sowings should take into consideration the size of grain, tillering-power, and amount of damage done by pickling. In the light of these considerations reasonable sowings on well-prepared land would be 65 lb. Velvet or Pearl, 76 lb. Hunter's, and 86 lb. Tuscans, increased to 90–100 lb. for August sowing.

Pickling: Wheat-smut can be controlled by pickling, and this practice should always be followed unless seed can be obtained from a crop guaranteed clean. Steeping the wheat overnight in half-sackfuls for seven minutes in diluted formalin solution—1 pint commercial formalin to 40 gallons water—has proved effective. Dusting with copper carbonate is increasing in favour in other countries, and the Department is making further and extended trials of this method during the present year.

Feeding off: On good wheat-land, where the spring growth is vigorous and early, feeding off increases the tillering and improves the yield. The best tillering variety is probably Hunter's, but Velvet, Pearl, and, to a less degree, Tuscan also benefit. A crop should never be fed off if there is likely to be a shortage of moisture later, and it should be fed off early to avoid eating-out of the flowering-stalk. A big mob of sheep should be used, and then the ground harrowed well to break the crust and break down the surface clods.

It may be mentioned that the foregoing notes apply also in general to North Otago conditions.

TOP-DRESSING OF PASTURES.

It is now realized by all up-to-date farmers, particularly in dairying and lamb-fattening districts, that top-dressing is one of the most important functions on the farm. In districts where the roads are likely to get out of repair early, supplies should be got on hand so that the work may be pushed along as time permits. There is quite a wide range of time as to when the fertilizers may be applied, but the following is suggested as a rough calendar for average districts: April to May—Nauru and other Island phosphates, Ephos phosphate, and bonemeal; May to July—basic slag, basic super, and mixtures of super and Nauru phosphate; July to September—super. Proprietary mixtures, as a rule, are best applied from May to July, but, as already mentioned, there is ample latitude.

The question as to what is the best fertilizer depends on local and other considerations, but in a general way the main thing is to use a good phosphatic manure. The best of these are basic slag, basic super, super, and mixtures of super and Nauru phosphate or super and bone. Where there is a rainfall of 40 in. or over any of the mixtures should give good results, but for preference probably basic super, basic slag, mixtures of half super and half Nauru, or super by itself. If the land has been previously limed, or it is the intention to lime, super may be used with confidence, but if no liming has been done or proposed it is a sounder practice to use a manure containing lime, such as basic super or basic slag. Very good results are obtained from the use of super,

provided there is sufficient lime available in the soil. If, however, super is top-dressed indefinitely a time comes when all the available lime is used up, and when this happens the results tend to be poor; hence the advisability of keeping up the lime-supply.

The quantity of fertilizers to apply per acre depends greatly on the condition of the pasture. If it is in first-class condition, from 1½ cwt. to 2½ cwt. per acre is ample. If, on the other hand, no previous manuring has been done and the pasture is getting weak, heavier dressings are necessary, and from 3 cwt. to 4 cwt. should be applied; after the first dressing subsequent applications may be reduced. In top-dressing, the aim should be to apply a fertilizer that will give good results the year following the application, rather than to use so-called lasting manures that may give a result in a year or two. The practice of medium dressings at frequent intervals, in preference to heavy dressings at long intervals, is recommended generally.

Where the land is reasonably level and free from stumps it is a good practice to harrow the pasture both before and after top-dressing.

GENERAL TILLAGE OPERATIONS.

Grassland intended to be broken up for spring crops, especially mangolds, carrots, millet, and maize should be skim-ploughed. Some of the heavy soils benefit greatly from a winter fallow; on the other hand, much of the lighter land leaches considerably, and is better sown in a green catch-crop of some sort. The climatic factor counts largely in this matter.

Those who intend growing mangolds for next season should select a suitable area and make early preparations. About 1 acre for every twenty cows is generally sufficient. Selection should be made of the cleanest field on the farm, with, if possible, a soil consisting of a deep friable loam or clay. Though normally the mangold gets through dry spells very well, it is safer and better practice to prepare for the crop early.

In the frostless belts where early potatoes are grown it is a common practice to sow in May. The ground should be well worked. An application of some 6 cwt. to manure consisting approximately of 4 cwt. superphosphate, 1½ cwt. sulphate of potash, and ½ cwt. sulphate of ammonia per acre should be found suitable in general.

Root-bound paspalum pastures can be renovated by ploughing now in narrow furrows about 4 in. to 5 in. deep. The ploughing is left during the winter, and the paspalum comes away between the furrows. In the spring the land is disked and harrowed, and a sowing of rye-grass and clovers, including subterranean clover, is made, together with a top-dressing of 2 cwt. to 3 cwt. of fertilizer per acre.

THE ROOT CROPS.

Feeding of the swede crop may be commenced in the coming month as required, more especially if disease is showing. Dairy-farmers using swedes should endeavour to pull and feed the roots daily on clean pasture, with a reasonable ration of hay, thereby saving

waste, while at the same time closely controlling the quantity of roots fed. Milk taint can thus be the better prevented and redwater more easily avoided.

Mangolds should be pulled during May, and stored in clamps for late feeding. For lifting mangolds the usual method on small areas is to work between two rows, pulling alternately with each hand; by a sudden jerk the tops are removed, and the roots dropped in rows handy for loading. Where larger areas have to be dealt with a couple of planks fixed on edge in the shape of a V and pulled by a horse from the apex will push the roots out of the ground into rows, but in this case the tops should be fed off previously with a mob of old ewes. Provided the weather is not too frosty, the roots should be left lying in the field for two or three weeks to ripen off. The real danger from frost is the effect on the part of the root which was underground, and which is very tender. Mangolds are excellent milk-producers for both dairy cows and ewes, but must be fed carefully in small quantities at the beginning, and with a fair allowance of hay. In the case of feeding off with sheep it is usual, provided the crop is a globe variety, to harrow out each break a few weeks ahead of feeding.

Carrots are best left in the ground and pulled for feeding as required.

It is a good plan to feed roots and hay on patches where the grass-grub has been at work, or on other poorer spots, and thus encourage consolidation of the soil and the trampling-in of seeds dropped from the hay.

MISCELLANEOUS.

Where ensilage is provided for dairy cows it should be fed in moderate quantities fresh daily in the field, and should never come into contact about milking-sheds, owing to the danger of tainting milk.

Small calf-paddocks should be broken up periodically and regrassed. Failing this they may now be eaten bare with big cattle, then top-dressed with about 10 cwt. of burnt lime per acre, following in August with 2 cwt. of superphosphate per acre.

Having regard to the prevalence of Californian thistle, it is good practice generally in the South to sow oats in autumn. The crop will then ripen before there is any danger of the thistle-seeds maturing. On the other hand, spring-sown oats, which do not ripen for a month or six weeks later, are frequently infested with mature thistle-seed, and this is one of the chief means by which the pest is spread.

Clover-seed and lucerne-seed in stack should be allowed to come out of the sweat before shelling is commenced. Fitness of the seed may easily be tested by driving a crowbar into the side of the stack, leaving it there for twelve hours, then taking it out to see whether the end inserted into the stack is warm or damp.

If feed is running short, pigs may be put on the artichoke crop in April, giving a fairly large break to avoid puddling during wet weather. Or stocking may be deferred for a couple of months if other feed is available.

The outlets of all drains should be attended to and put in good running-order before winter sets in. It is a good thing for every farmer to have a sketch-plan of his farm, showing each field and where watercourses and drains are situated. —*Fields Division.*

THE ORCHARD.

THE AUTUMN CLEARING-UP.

WITH a number of growers the beginning of May will see the fruit harvest gathered and disposed of, and time will then permit of a general clearing-up preparatory to commencing the winter work.

Following a dry summer, one should be prepared for a wet autumn and winter, and it will be well to give consideration to the matter of drainage. Existing drains will probably require cleaning out, and it is a good policy to divert surface water into these by the most direct route so as to save loss of soil.

The time will also be opportune for searching out and destroying trees badly affected by such diseases as silver-blight, and removing limbs similarly affected in otherwise healthy trees. Unless this is done while the foliage is still on it is not possible to distinguish the affected branches, and the trouble is carried over to the spring again.

During the rush of the season the mummified remains of peaches, plums, &c., affected with brown-rot are often left on the ground. These should now be gathered up and deeply buried or otherwise destroyed.

STONE-FRUIT TREES.

At this time, though it may not be desirable to commence winter pruning, much good may be accomplished by removing the surplus growths inside overvigorous and congested stone-fruit trees, so as to enable the buds to ripen up and the wood to harden for next season's crop. After this the trees may be sprayed with 6–4–40 bordeaux for the prevention and eradication of brown-rot spores, rust, and other fungi common to stone-fruits.

PLOUGHING.

In localities where green crops have not been sown the land can be turned up for the winter, taking care to do this in such a way that the water will be diverted from the trees. On heavy soils the turning-over of the land is beneficial at this stage, as the winter frosts will help to break up the areas that have become packed through the constant carting with the spray-pump and fruit-carts. Areas intended for orchard-extension should also be deeply ploughed now in readiness for working down and planting in the spring-time.

NEW PLANTINGS.

Decision should now be made as to what varieties are needed, and orders given at once so as to obtain the best trees. Those who order last when stocks are running low usually get the worst bargain. In some localities and good friable soils planting can be done to advantage in the autumn. —*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

If the land has not yet been put in order for the winter this should be done at once, leaving the soil in a rough state where green crops are not being grown, but well worked down otherwise. In all cases the plot should be so graded as to provide an easy run-off for surplus moisture. Generally the best way to do this is to leave an open furrow in the middle of each land inclining with the fall of the plot.

Some pruning may be done at this season; indeed, it is essential that all branches which are likely to touch the ground should be removed prior to the wet season, if the spread of lemon brown-rot is to be prevented. Throughout the trees will also be found many long summer growths. These should be cut back to about half-length in order to induce fruiting lateral growth, and any which are in excess should be cut clean out, as also should the very perpendicular type of growth, particularly from the inside of the tree. Keep a lookout for limbs or branches which cross each other, and cut sufficiently clear to prevent rubbing. Much damage is caused by this kind of bark-injury during rough winter weather, which timely pruning would have prevented.

Sites on which it is proposed to plant citrus-trees during the coming planting season should be prepared now. The first essential is good drainage; and if this is not natural, artificial drains should be put in at intervals suitable to drain the type of soil. A thorough cultivation of the land—ploughing and subsoiling—should be carried out; time spent in levelling up irregularities of the surface will be well repaid in after-years.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

WINTER EGG PRODUCTION.

THE season is now at hand when maximum prices rule for strictly fresh eggs. As the great bulk of the adult birds will be resting and undergoing the moulting process, the pullets must be chiefly relied upon to produce these eggs. Thus the chief concern of the poultry-keeper at the present time should be to give the pullets the best possible attention in order that they may produce to their maximum capacity.

The poultry-keeper who succeeds in obtaining a high winter production leaves nothing to chance; he realizes that such eggs are an out-of-season and artificially stimulated product. In the spring and summer months, when the hen lays naturally, it is a simple matter to secure a good egg-yield, but even with the bird bred to lay in winter it is entirely different. The slightest error made in managing the pullets when commencing to lay is not only apt to cause a false moult, but in addition to give the birds a setback that is not recovered for weeks, and sometimes months. In short, everything should be done to provide conditions resembling those that prevail in spring and summer—in other words, the natural laying season.

In the first place, the house should be roomy—not merely enough for the birds to roost in by night, but sufficiently large to accommodate

and to provide exercise in comfort for all the birds when unfavourable weather conditions prevail. It is of the first importance that the birds be fed under cover at all times, and not compelled to wait about in the yard for feeding-time on cold and wet days. Exercise is another important matter which must not be overlooked. The value of exercise as a means of promoting winter laying is not so generally realized as it should be. To induce exercise the floor of the house should be thickly littered with straw, and the dry grains of the evening meal scattered therein. Sufficient grain should be given so that some is left over for the birds to scratch for in the early morning.

Hand-in-hand with good housing and comfortable conditions should go regular and liberal feeding. There is no greater mistake made than the idea that the heavy layer when fed on the right class of food can be overfed and become too fat to lay. Another important point is not to subject the laying pullets to frequent changes of food. The more uniform the treatment they receive in all respects the less risk will there be of their going into a premature moult.

Only the best grain materials available should be used. At the present price of eggs it will pay to feed the best foods irrespective of cost, within reason. In this connection poultry-keepers should beware of some of the so-called pollard that is on the market. Some of the samples which have recently come under my notice would be next to useless for promoting egg-production. Indeed, it is a rare thing to see good pollard in these days, even at its present extreme price, and it would appear that a substitute will have to be found to wholly or partly take its place. A good material for this purpose is finely ground wheat. One part of wheatmeal to two parts of bran is recommended, the proportions being varied according to the quality of the wheat. Unfortunately, as with pollard, much of the wheatmeal on the market is of a decidedly inferior quality, and where possible poultry-keepers are recommended to choose their own sample of wheat and get it ground specially.

The mash should be made as appetizing as possible by moistening it with meat soup, milk, or hot water. For the evening meal wheat, when available, should be looked upon as the stable grain. It is, however, a good plan to mix oats and maize with it. During cold weather the grain ration may consist of at least one-third maize, but in hot weather this should be given in a less quantity. The manner in which the birds appreciate the different kinds of grains must also be taken as a guide. When it is observed that they are leaving any particular grain, this should be given in reduced quantity. Of course, this only applies where all the grains are of good quality, as fowls dislike inferior or damaged grain.

In addition, the ration should include meat, or meat-meal, preferably fed by itself. These forcing-foods are specially demanded to ensure a good supply of eggs during the cold months of the year. Care must be taken, however, that such foods are not oversupplied, especially in the mash, or it will have the inevitable result of bringing on ovarian troubles, protrusion of the oviduct being a common phase.

Green food should be provided in abundance, and likewise the grain materials referred to. Grit is another essential to the well-being

of fowls of all ages, and should be always available for them to pick at. It should be remembered that fowls have no teeth with which to masticate their food, and that grit acts as a substitute. Proper digestion cannot take place unless the gizzard contains sharp gravel, grit, or similar material, and without good digestion a bird cannot maintain good health and a highly productive condition. In addition to grit, laying hens should have crushed oyster-shell or other fresh sea-shell always in reach to provide egg-shell-forming material. Burnt or charred bones, put through a grit mill, are also good for shell-making, and are much relished.

Finally, care should be taken that there are no cracks in the back or side walls of the house to let in cold draughts—a most common cause of colds and the forerunner of roup. The common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dirt and dust adhere. In severe cases the discharge will usually be found on the feathers under the wing, owing to the bird sleeping with its head thereunder. When any of these symptoms manifest themselves the first essential is to find the cause and remove it, for, as with most troubles affecting poultry, it is next to useless trying to cure the trouble if the cause is not first removed.

CULLING THE WRONG BIRDS.

In previous notes published in the *Journal* much advice has been given regarding the class of bird that should be culled from the flock, and the one that should be retained for profit-making. It has been pointed out over and over again that the late autumn is the best time for culling a flock, and that the heaviest layers are the thinnest at this period and present the most worn and shabby appearance, while the heaviest and best-looking birds are the drones. That many poultry-keepers are not familiar with the points indicating high or low egg-producing capacity is borne out by the large number of birds sent to market which are not only in a highly productive condition, but which also give striking indications of being the best future profit-makers. Obviously, in such cases the bird that has laid well in the past and is likely to in the future has been discarded, while the poor layer in the past and necessarily a drone in the future has been retained on the plant.

This common mistake of weeding out the wrong birds is undoubtedly due to their rough shabby appearance, and ignorance on the part of their owners in not knowing that the apparent worse-for-wear condition is solely due to heavy production. It is safe to say that thousands of pounds' worth of eggs are lost annually by poultry-keepers through lack of knowledge in culling their flocks to the best advantage. The worst feature is not so much the first loss in eggs, but rather the great deterioration that must ultimately follow by using the weak types remaining on the plant for future breeding purposes.

Poultry-keepers lacking in experience in culling and who are desirous of assistance are reminded that the services of the Department's Poultry Instructors are available free of cost for the purpose. Applications for assistance should be addressed to the Poultry Instructor, Department of Agriculture, at Auckland, Wellington, or Christchurch.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

MANAGEMENT OF SUPERS.

As advised previously, the removal of the supers should go on steadily while the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and unduly crowding the bees. In these cases it is best to leave the supers on till the spring.

The best place for winter stores is in the hive, and however careful the beekeeper may be in replenishing these, if the honey is removed from the hives he still runs the risk of allowing the bees to starve if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, as the bees require food at all times and seasons. On no account should they be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show the beekeeper whether this state of affairs obtains, and, if so, he should remove the bottom story, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

MATS FOR WINTERING.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

CLEARING WEEDS.

Weeds should be kept down in the apiary. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the extrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

UNITING COLONIES.

The presence of weak hives in the apiary must be avoided as far as possible. During the warm autumn days these colonies rarely escape the attention of robber-bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is by far the better plan to unite them with a stronger colony than to run the risk of unsettling the bees in the dormant season through the encouragement of wholesale robbing.

"PRACTICAL BEE-KEEPING."

By courtesy of Messrs. Whitcombe and Tombs, Wellington, I am in receipt of a copy of "Practical Bee-keeping," by the late Isaac Hopkins, being the sixth edition of the Australasian Bee Manual. In the preparatory note to the first edition of his Manual, published in 1881, Mr. Hopkins expressed the hope that the book would be the means of assisting to place apiculture on a proper footing in New Zealand, and help to make it as profitable as in England, America, and on the Continent of Europe. He lived long enough to see his hopes fully realized, as New Zealand stands to-day among the more important honey-producing countries in the world. His early influence on the craft was directed towards the adoption of the modified Langstroth hive, and to-day our position is unique in that we have a standardized hive throughout New Zealand. The present edition is full of practical advice, and covers every phase of the art. Mainly devoted to the practical side of the business, it will be found useful to the amateur or advanced beekeeper who is desirous of gaining an insight into honey-production as practised in New Zealand. The book is well and clearly illustrated, and this helps the reader to follow the instructions given in the text. The chapter devoted to the preparation of honey for marketing is especially valuable to the commercial honey-producer. Concise instruction is given on the use of the hydrometer in testing honey for ripeness, and the advice cannot be too closely followed. "Practical Bee-keeping" is up to date, and forms another valuable contribution to the bee-keeping literature of the day. —*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE harvesting and storing of the late vegetable crop will now be nearing completion, and care must be taken to avoid attempting the impossible. Too often varieties quite unsuitable for long storage are kept until they are wasted, and samples of varieties that are known for their long-keeping qualities but which are not in their best condition are held too long. A grower must acquire by experience a keen judgment of produce *condition* if he is to make the most of it and avoid waste. During the first few weeks of storage fresh vegetable products give off considerable moisture, and are liable to heat if large quantities are placed in one stack. Losses due to these conditions can

be avoided by giving ample ventilation for a while and maintaining an even temperature.

Where a good rotation of crops is practised vegetable litter may be turned in, but where successive crops of the same or similar kinds are grown, as is unfortunately so often the case through compulsion on high-priced land, all litter should be carefully burnt. Onions, tomatoes, &c., that are planted on the same ground from year to year would be better grown if the fungus-infected foliage were completely burnt up as soon as possible after harvesting. In such cases it is unsuitable for digging in for the humus it might contain; better to burn it and plant a cover-crop that is not affected by the same diseases. By such means, to some extent, are parasitic fungi starved out of the land.

Seedling beds of main-crop cabbage, cauliflower, peas, lettuce, and autumn-sown onions must be kept carefully weeded. Plant out cabbage and cauliflower for early spring cutting. Such crops, after some growth has been made, are sometimes moulded up in windy and exposed localities. Carefully select and set aside seed potatoes. If they have to be obtained from a distance, have them forwarded as soon as they are available. Remember, like breeds like, and the crop will be all the bigger if the seed has been well wintered.

THE PLANTING SEASON FOR TREES AND SHRUBS.

We are now approaching the short period—three or four months—which is regarded as the planting season, in which deciduous and evergreen trees and shrubs may be transplanted with every chance of success. It is an opportunity which demands the careful attention of every man on the land. There are few places where cheap and remunerative improvements could not easily be made by improving, if not planting new shelter-belts and shade-trees. The damage from occasional heavy winds at a critical period of growth exacts a substantial toll from the cultivator of the soil. On good alluvial land a single line of populars is often preferred, and does good work when kept within bounds. One case was seen lately where a great improvement had been made by interplanting privet between the poplars, the result being a fine dense growth between the trunks that afforded shelter where it is often weak and badly wanted. Many shelter-belts would be improved by underplanting, more especially on the windward side.

Successful planting depends more than anything on its suitability to the local soil and climate. Man's skill can contribute something to that success under any circumstances, but it is of little use unless the locality is suitable for the selected trees, each kind and sometimes variety of which has a strong preference for a special environment. A close study of the older plantations in a locality will supply much useful information on this point.

NUTS.

The demand for nuts—as shown by our import statistics—might well receive more consideration from planters. The common bacterial blight of the walnut (*Pseudomonas juglandis*) has prevented many from planting this valuable species, but the headway made against these attacks in other countries is encouraging, and indicates excellent chances

of success if the proper precautions are taken. These trees prefer, and require if planted commercially, a well-drained alluvial soil in a locality that usually has dry summer weather. Planted along the headland of an orchard or paddock they afford useful shade and some shelter. As an avenue on flat country they are very handsome and profitable; or they may be planted in blocks or groves like fruit-trees. Like other trees they vary in susceptibility to blight, and for this reason careful search is being made for the highest possible degree of immunity among the trees in each locality, in order to provide material for propagation. The Persian walnut (*Juglans regia*) — usually known as the English walnut—which is the species most commonly grown, has at maturity a spread usually of 60 ft. This is a fact sometimes overlooked by planters. For the maximum production of nuts the branches of adjoining trees must not interlock.

The sweet or Spanish chestnut is a wholesome nut in considerable demand. It is a good shade-tree, with useful timber, and does best in good hill country.

Hazels, filberts, and cobs, or, as they are known in commerce, Barcelona nuts, have been planted in many localities in the Dominion, but usually they are barren. This is chiefly due to their being planted on heavy land, and allowing strong water-shoots to crowd the trees. They are more thrifty on the poorer land, and should be pruned somewhat like an apple-tree, leaving the leaders well clothed with twiggy laterals. Treated in this way they are doing well in two or three places here, but there seems to be no reason why more successful plantings should not be made, and something more done to supply from our own plantations the keen demand for this popular nut.

HEDGE-TRIMMING AND DRAINAGE.

The trimming-up of hedges before the wood hardens, and the clearing of watercourses and drains to allow a quick clearance from winter rains, is good work at the present time. Much good land devoted to fruit and vegetable culture suffers badly from stagnant water in the subsoil for considerable periods during winter through the drainage, that may have been put in at considerable expense, being more or less obstructed just when it is most needed.

TOBACCO-CURING.

The tobacco harvest will now be completed, and the crop will be undergoing the process known as curing — drying the leaf out to a bright even colour. The most difficult portion of the leaf to cure is naturally the thickest—that is, the stem or midrib. The progress of the operation can best be judged by the condition of the base of the stem where it joins the plant-stalk.

The method of curing leaves on the stalk demands a stripping process, which takes place any time during the winter in a humid atmosphere, when the leaves are in a tough, pliable condition that permits them to be handled without breaking. A stalk is taken from the curing-stick and, holding it in the left hand, each leaf is carefully stripped and placed in its special grade. The leaves are then tied into bundles of one dozen, known as a "hand." They can then be placed astride of the curing-sticks in the curing-shed again, to await the fermentation process of the spring season; or, if the curing is

complete, and it is desired to market them at once, they may be baled up. The latter operation is sometimes indifferently performed; a substantial press is necessary to turn out bales that are firm and compact; only such will stand the necessary handling without depreciation.

In the case of the tobacco being held over, it should be carefully watched during the winter, specially in dull weather, to see that it is not attacked by mould fungus—the result of excessive moisture and a low temperature. Should such a condition threaten, means must be taken to dry the leaf and raise the temperature of the curing-shed.

—*W. C. Hyde, Horticulturist.*

USED MOTOR-OIL FOR ORCHARD-SPRAYING.

USED heavy motor-oil for orchard-spraying during the dormant period has been tried by Mr. C. Calvert, of Myross Bush, Southland. It proved quite effective as an insecticide on old apple-trees badly affected with woolly aphis. The common use of oil-engines and the need for drawing off the used oil from the crank-case occasionally makes this material (which is usually thrown away) generally available in small quantities, but sufficiently large for an application to the domestic or farm orchard. It should be applied during the dormant period in autumn or early spring. Preparation is as follows: Place in a vessel 1½ lb. household soap and 1 gallon oil, and heat them over a fire till the soap is dissolved; remove from the fire, and with a spray-pump thoroughly agitate the contents, at the same time slowly adding ½ gallon water; when the emulsification is complete add 11½ gallons water; the mixture is then ready for use. It is imperative that the water should be soft. Where this is questionable add 2 oz. washing-soda to every 4 gallons water. Rain-water is always to be preferred for the mixing of spraying-compounds.

—*Horticulture Division.*

PRESERVATIVE TREATMENT OF FENCING-POSTS.

THE preservative treatment experiments carried out at the Dunedin Exhibition during February and March included tests on over five hundred fencing-posts, consisting of pines, beeches, and kamahi. Satisfactory methods of treatment were developed for all the timbers tested, the times of immersion in the hot and cold baths of creosote in order to obtain ½ in. penetration being as follows:—

	Hot Bath. Hours.	Cold Bath. Hours.
Austrian pine	¾	½
Corsican pine	¾	½
Ponderosa pine	¾	½
Kamahi	4	2
Mountain-beech	6	4
Silver-beech	6	4
Red-beech	3	2½

The estimated cost of treated posts cut from the farm woodlot is between £8 and £10 per hundred. They should have an average life of fifteen to twenty years, thus comparing favourably with the durable untreated posts of native and imported woods, costing from £10 to £18 per hundred delivered on the farm.

—*N.Z. State Forest Service Newsletter.*

POME, CITRUS, AND STONE FRUIT CULTURE IN NEW ZEALAND.

MANY fruitgrowers in this country have an excellent knowledge of the practice of the various operations, such as cultivation, pruning, spraying, and harvesting, necessary for the production of the various fruits, and such men are excellent assistants in the orchard. The owner or orchard-manager, however, who directs these operations can only do this economically and effectually from year to year and with a high degree of success if he has, among other things, a real knowledge and interest in the weather, land, manures, trees, sprays, blights, diseases, and markets, and their relationship to one another. It is possible to manage an orchard by routine with more or less success so far as crop-production is concerned, but it does not necessarily follow that this is economical. At the end of the average season the balance will be small, even when it is on the right side.

It is not sufficient, for instance, to prune an orchard on some recognized system. An assistant can do that quite well; but the efficient manager must lay down the policy for pruning each kind and variety from year to year—whether the trees should be pruned hard or lightly, or merely thinned, &c. Even in a block of one variety there are sure to be a few stunted trees and one or two of particularly rank growth, which in both cases will require individual treatment. This demands an intimate knowledge of the structure and functions of the tree and the special habits of each variety. And so with spraying: an assistant can carry out an elaborate spray programme without supervision. The efficient manager, however, will have specially diseased trees marked down when pruning and give them special treatment. He will have a knowledge of the peculiar susceptibility or immunity of each variety to certain diseases, and of the effect of any kind of weather at all seasons in assisting or retarding those attacks. With this knowledge he will introduce differential spraying with considerable economy, and in difficult years with a higher percentage of success. And so on with every important factor of the industry, an intimate knowledge of the underlying causes and a quick intuition are necessary.

This phase and its importance might well receive more attention from owners and orchard-managers, and those who aspire to that position. Good literature along these lines is scarce, and specially that which deals with New Zealand conditions, which naturally are very different from those on the Continents of America and Europe. Our Dominion growers are fortunate in now having at their command such a work as "Fungous Diseases of Fruit-trees in New Zealand and their Remedial Treatment," by G. H. Cunningham, M.Sc., Mycologist, Department of Agriculture, published by the New Zealand Fruitgrowers' Federation. This work deals with practically all the serious fungous diseases—and many others—which affect pome, stone, and citrus fruits in the orchard and storeroom.

Take the example of that fungus which levies such a heavy toll of our stone-fruit crop—brown-rot. Under that heading we are given its scientific name and a list of synonyms, both scientific and popular, under which it has been known in the past and elsewhere—information which immediately dispels a cloud of misunderstanding. There follow some notes on its history and introduction into this country. A very complete statement then follows each of these headings: Appearance and Effect on the Hosts, Economic Importance, Life-history of the Organism, and Considerations Regarding Control, finishing with a brief and useful summary of the information that is so useful during hurried moments when one wishes just to refresh the memory. The statement is illustrated with abundant plates from excellent photographs of affected leaves, twigs, and fruit, as well as original line drawings of important sections as seen under the microscope. Illustrations, upon which the practical man depends so much for the identification of disease, are most important, and are here supplied in an exemplary manner. In a similar manner the other fungi affecting fruit-trees are dealt with, the whole work being made convenient for ready reference by an excellent range of type such as is rarely found in such works.

An unusual feature in works of this class are four chapters dealing with "Remedial Treatment," in which the subject is fully dealt with in a modern manner, and one that is suitable for this country. A chapter dealing with losses in fruit crops due to disease includes valuable tables of varieties of fruit highly and moderately susceptible to the different fungi, also the desirable varieties that

are resistant. What economies in spraying might have been made in the past with a better knowledge of this section!

One of the most valuable sections of the book is that on the botany of the fruit-tree, which deals with the cell and its contents, the structure and functions of root and branch, and the leaves and fruit—that, too, in lucid language as free as possible from technical terms. With its excellent illustrations and readable text this information is supplied in a manner that makes its assimilation by the reader easy and pleasant.

It will be seen that the book covers a far wider range than its title would suggest. Many of the fungous diseases had been dealt with previously by Mr. Cunningham in this *Journal*, but that section has now been consolidated, and the work expanded into what almost amounts to an orchardist's handbook. As a contribution to the economy of fruit-culture in this country the book is valuable and unique.

W. C. H.

WINTER FARM-SCHOOLS, 1926.

THE Department of Agriculture has arranged short courses of instruction for farmers in the various districts as follows:—

Auckland.—(1) At Dargaville, 17th to 21st May; (2) at Whangarei, 24th to 28th May; (3) at Hamilton, 31st May to 4th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Auckland.

Taranaki.—At New Plymouth, 5th to 10th July. Enrolment with Instructor in Agriculture, Department of Agriculture, Wanganui.

Hawke's Bay.—Travelling school, 27th June to 3rd July. Enrolment with Instructor in Agriculture, Department of Agriculture, Hastings.

Southern Hawke's Bay and Wairarapa.—Travelling school, 12th to 17th July. Enrolment with Instructor in Agriculture, Department of Agriculture, Palmerston North.

Marlborough.—Travelling school, 22nd to 26th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Blenheim.

Canterbury.—Travelling school, 10th to 22nd May. Enrolment with Instructor in Agriculture, Department of Agriculture, Christchurch.

Otago.—Travelling school, 7th to 15th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Dunedin.

Southland.—Travelling school, 16th to 19th June. Enrolment with Instructor in Agriculture, Department of Agriculture, Invercargill.

Westland.—Travelling school, 19th to 24th July, Enrolment with Fields Instructor, Waimaunga Experimental Farm, Mawheraiti.

Details of the respective schools (programme, accommodation, &c.) will be published in the local Press in each case. Any further information desired may be obtained from the individual enrolling officers. Early enrolment is advisable.

Wheat and Oats Threshings.—Returns of actual threshings up to 19th March received by the Government Statistician from threshing-mill owners showed that until then 752,712 bushels of wheat and 415,744 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 29·93 bushels for wheat and 33·47 bushels for oats. The figures for the Canterbury and Otago Land Districts respectively were as follows: Canterbury—Wheat, 650,152 bushels threshed, averaging 29·77 bushels per acre; oats, 291,677 bushels threshed, averaging 39·93 bushels per acre. Otago—Wheat, 48,804 bushels, averaging 37·17 bushels per acre; oats, 96,805 bushels, averaging 43·47 bushels per acre. No threshing returns had been received from Southland at the date referred to.

Correction.—In the Red Poll class-averages for 1925, at top of page 165 in last month's *Journal*, the word "senior" in the third line should be omitted, and the words "Three-year-old" substituted for "Mature" in second line of table.

IMPORTATION OF PEDIGREE STOCK INTO BRITAIN.

CONDITIONS FOR LANDING AND FORM OF APPLICATION

THE following memorandum of conditions under which the Minister is prepared to consider applications (under section 1 of the Importation of Pedigree Animals Act, 1925) for the landing in Britain of such stock was issued, together with the form of application, by the British Ministry of Agriculture in July last, and is here reproduced for the information of those concerned.

Conditions for Landing.

1. Section 1 (1) of the Importation of Pedigree Animals Act, 1925, enables the Minister to make orders authorizing, subject to the conditions prescribed in such orders, the landing of cattle, sheep, goats, or swine brought from any part of His Majesty's dominions, which are shown to the Minister's satisfaction to be there registered as pedigree stock in a herd or flock book recognized by him after consultation with the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland, to be landed in Great Britain without being subject to Part I of the Third Schedule to the Diseases of Animals Act, 1894 (Slaughter at the Port of Landing) but subject to Part II of that schedule (Quarantine).

2. The Act of 1925 also provides that no such order may be made except with respect to animals brought from a part of the dominions in which pedigree animals from Great Britain are allowed to be landed either unconditionally or subject to conditions (including rates of import duty) which in the opinion of the Minister are not unduly restrictive.

3. Before authorizing the landing of any animal under the Act of 1925 the Minister will require to be satisfied in the case of each application that the above-mentioned conditions are complied with, and also that no risk of the introduction of disease would be entailed by the conditions existing in that part of His Majesty's dominions from which the animal is proposed to be imported. A certificate will be required from the Government of the exporting country as to the freedom from disease, immediately before shipment, both of the animals and of the country from which they are brought. The certificate in the case of cattle should show that each animal has been submitted to the tuberculin test within one month immediately prior to shipment and has shown no reaction. The temperature-charts should be attached to the requisite certificate in cases where the subcutaneous tuberculin test was carried out. In cases where the intradermal, or intrapalpebral, or ophthalmic tests have been carried out (either independently or in conjunction with the subcutaneous test) an accurate description of the reaction, if any, should be inserted on the certificate.

4. The landing of the animals, if authorized, will be subject to the provisions of the special order of the Minister authorizing the landing, and regulating the detention and isolation of the animals at a quarantine station at the port of landing to be defined by the order, and imposing strict requirements as to inspection of the animals during quarantine, and the cleansing and disinfection of the premises, &c. No forage or litter that has been in contact with the animals to be imported may be landed. The Ministry will reserve to itself the right to retest any cattle in the quarantine station in any case in which it considers such a test necessary.

5. In the case of each importation a period of quarantine will be specifically imposed by the order authorizing the landing, which will not usually be less than twenty-eight days, and which, in certain cases, would be extended to six months.

6. It rests with the importer to make the necessary arrangements for the acquisition of premises to be used as a quarantine station (subject to the approval of such premises by the Ministry) and for the care of the animals, and to defray all expenses connected with the importation and with the detention of the animals during the period of quarantine, except the expenses incurred in the veterinary supervision of the animals during that period, which would be undertaken by the Ministry without charge, provided that the port is one at which a Veterinary Inspector of the Ministry is stationed.

7. The premises selected for quarantine must meet the requirements of the Ministry as regards structure and suitability, and be in close proximity to the wharf at which the animals are landed. Definite arrangements for shipment

should in no case be made until authority for the importation has been granted by the Minister and the place of quarantine approved.

8. In no case will the Ministry accept any liability for any loss occasioned at any time by the death or illness of any animal imported under the Act, or by any accident or injury to any such animal. No compensation is payable under the Diseases of Animals Acts in respect of any animal which, having been allowed to be landed under the Act of 1925, is slaughtered in a quarantine station by reason of its being diseased or suspected of disease, or of its having been exposed to the infection of any disease.

Form of Application.

MINISTRY OF AGRICULTURE AND FISHERIES.

DISEASES OF ANIMALS ACTS, 1894 TO 1925.

Application to the Minister of Agriculture and Fisheries for Permission to land Pedigree Animals, subject to Quarantine, in accordance with the Provisions of the Importation of Pedigree Animals Act, 1925.

1. Full description—*e.g.*, number, species, sex, of the animals for which permission is desired :
2. Name of port and country whence the animals are to be shipped, and place of their origin :
3. State name of herd or flock book in which the animals are entered (evidence of this will be required—*e.g.*, the registered numbers and names, if any, of the animals) :
4. Address of keeper of the herd or flock book referred to in 3 :
5. Name of the port in this country at which the animals will be landed :
6. Names of ports at which the vessel bringing the animals will touch on the voyage :
7. Full description of premises proposed for definition as a quarantine station for the purpose of the landing and quarantine of the animals, and name and address of the occupier :
8. Name and address of applicant :

I have read the conditions printed on the back of this form, and agree that, in the event of my application being authorized, I will comply with those conditions, and any other conditions, as to quarantine or otherwise, subject to which the Minister may authorize the landing of the animals.

I also agree to accept all responsibility for all expenses incurred in connection with the importation, and for any loss occasioned by the death or illness of the above-mentioned animals, or by any accident or injury to the animals, whilst in quarantine or subsequently.

[*Signed*]

Date : , 19

N.B.—*This application must be made before the animals are embarked, and cannot be entertained unless the Ministry is placed in possession of full particulars.* The replies to the above questions should therefore be as complete as possible, and the application should be addressed to the Secretary, Ministry of Agriculture and Fisheries, Whitehall Place, London S.W. 1.

FORTHCOMING WINTER SHOWS.

Flaxbourne A. and P. Association : Ward, 12th May.
Franklin A. and P. Association : Pukekohe, 28th and 29th May.
Otago A. and P. Society : Dunedin, 1st to 4th June.
Waikato Winter Show Association : Hamilton, 1st to 5th June.
Auckland Winter Exhibition : Auckland, 9th to 19th June.
Manawatu A. and P. Association : Palmerston North, 15th to 19th June.
Wanganui A. and P. Association : Wanganui, 24th to 26th June.
Wellington Show Association : Wellington, 10th to 24th July.

WEATHER RECORDS: MARCH, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

ATMOSPHERIC pressure was above normal during the greater part of March, and dry weather predominated; but some heavy and welcome rains occurred about the 23rd, 27th, and 31st. On the 23rd a small but rather intense cyclonic disturbance passed through Cook Strait, and this was followed by another on the 26th.

Rainfall was above the average for the month in the Wellington, Nelson, and Marlborough districts, also at Hokitika, Westport, and Otira; it was also above the average at Kawhia, but less than usual for the month of March in all other parts of the Dominion.

Westerly gales were experienced about Cook and Foveaux Straits on the 7th, 8th, and 9th, and severe winds also occurred about the 23rd and 31st. Generally, however, there was little wind during the month.

Conditions were, on the whole, mostly cool and fair. The rains during the latter part of the month eased the situation for farmers in many parts of the country, particularly in the North Island, and will, it is hoped, produce growth for winter feed.

—D. C. Bates, Director.

RAINFALL FOR MARCH, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	1·96	9	0·79	3·58
Russell	1·80	9	0·64	3·42
Whangarei	0·67	7	0·38	5·10
Auckland	2·42	9	0·92	3·03
Hamilton	2·88	13	0·94	3·74
Kawhia	3·66	10	1·04	3·12
New Plymouth	3·48	12	0·74	3·62
Riversdale, Inglewood	6·49	11	1·82	7·39
Whangamomona	4·95	10	1·34	5·46
Tairua, Thames	4·26	7	1·70	6·73
Tauranga	2·99	9	1·02	4·16
Maraehako Station, Opotiki ..	2·68	9	0·90	3·90
Gisborne	0·79	12	0·20	4·51
Taupo	2·15	5	0·92	3·53
Napier	1·06	6	0·36	3·29
Maraekakaho Station, Hastings ..	0·87	7	0·40	3·10
Taihape	1·69	11	0·67	2·95
Masterton	1·98	5	1·04	3·15
Patea	3·38	8	1·32	3·60
Wanganui	2·03	6	1·00	2·60
Foxton	2·56	5	2·00	2·36
Wellington	4·45	7	2·45	3·28
South Island.				
Westport	6·00	12	1·62	5·80
Greymouth	7·35	14	2·28	9·12
Hokitika	12·91	13	5·78	9·72
Ross	14·72	13	6·39	10·35
Arthur's Pass	10·53	10	3·01	5·84
Okuru, Westland	8·12	12	2·59	15·48
Collingwood	10·75	9	4·25	4·19
Nelson	3·54	7	2·55	3·08
Spring Creek, Blenheim ..	3·32	5	1·70	1·81

RAINFALL FOR MARCH, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Tophouse	3·47	7	1·53	3·44
Hanmer Springs	2·31	5	1·70	2·92
Highfield, Waiau	1·86	5	1·20	3·09
Gore Bay, Cheviot	1·30	6	0·93	2·14
Christchurch	1·23	8	0·76	2·05
Timaru	1·46	7	0·92	2·45
Lambrook Station, Fairlie ..	1·74	4	0·87	2·58
Benmore Station, Clearburn ..	1·73	4	1·02	2·64
Oamaru	0·83	7	0·44	1·77
Queenstown	1·15	4	0·64	2·63
Clyde	0·51	3	0·37	1·50
Dunedin	1·38	9	0·42	2·99
Wendon	1·28	5	0·40	2·93
Gore	1·40	11	0·61	3·23
Invercargill	2·04	13	0·84	3·86
Puysegur Point	5·79	15	1·32	8·00

REGULATIONS REGARDING THE GRADING OF POTATOES FOR SALE IN NEW SOUTH WALES.

THE following official regulations governing the grading of potatoes for sale in New South Wales include in their application importations into that State, and must therefore be observed by exporters of New Zealand potatoes :—

There shall be two grades of potatoes—viz., No. 1 grade and No. 2 grade. These grades shall consist of potatoes which are sound, of similar varietal characteristics, and of normal shape, practically free from dirt and other foreign matter, and not affected by second growth, sprouting, injury, or deterioration.

Potatoes of No. 1 grade shall, in the case of round varieties, be not less than 2⅛ in. in diameter, and, in the case of long varieties, shall be not less than 2 in. in diameter. The diameter of potatoes in No. 2 grade shall not be less than 1¾ in.

Potatoes shall be deemed to comply with the above-mentioned grades if at least 92½ per cent. by weight thereof comply with the requirement as to size, and if at least 95 per cent. by weight comply with the other requirements of the said grades.

Potatoes shall not be packed for sale or sold unless they comply with one of the grades mentioned in the preceding regulation and unless the grade is legibly written on the covering in letters not less than 2 in. in height : Provided that (*a*) potatoes which are intended for planting and which comply with the requirements of the above grades except as to size may be packed for sale or sold in coverings which are legibly marked "Seed Potatoes"; and (*b*) potatoes which are intended for stock-food and which do not comply with the above grades may be packed for sale or sold in coverings legibly marked "Stock Food."

Bees and Fruit-tree Spraying.—In his book "Practical Bee-keeping" the late Isaac Hopkins remarks on this subject as follows : "I understand from those well up on the subject that it is wrong in principle to spray fruit-trees for codlin-moth with the usual poisonous mixtures while in blossom. This I do know, that to do so not only destroys the fructifying pollen-grains, but also kills the bees which visit the flowers, and thus prevents cross-fertilization. In some of the American States there are laws which make it penal to do so. I am informed that it is not frequently done in New Zealand, and I am pleased to hear it."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GROUND LIMESTONE AND BURNT LIME.

R. H., Devonport :—

Kindly inform me what are the relative values of ground lime rock and the ordinary burnt lime in (*a*) effect upon the mechanical condition of the soil, (*b*) effect upon making the plant-food available, (*c*) quantity per acre necessary.

The Fields Division :—

With reference to your queries (*a*) and (*b*) : You are no doubt aware that the ground lime rock mainly consists of carbonate of lime. When this is burnt there is a loss of weight of about 44 per cent. and there results a new substance with different properties. Burnt lime acts more quickly because it is partly soluble in water, and it is more evenly divided, hence it becomes better distributed throughout the soil. In the second place, its effect in ameliorating clay soils is quicker and better than that of ground carbonate of lime. Again, lime in solution has an effect of acting upon the organic matter in the soil and making available useful plant-foods contained in the organic matter. Further, it is claimed by soil investigators that burnt lime—but not ground limestone—has a beneficial effect on the small forms of life found in the soil. It promotes greater bacterial activity, and consequently increases the available nitrates. In reacting upon the organic matter of the soil it thereby supplies food for the bacteria and other useful forms of life in the soil. Concerning actual field evidence in New Zealand regarding the points referred to, there is very little information, especially from systematic field experiments. On the clay gum-lands at Puwera, burnt lime gave better results in bringing about good tilth than ground carbonate of lime. Our practice in New Zealand is based mainly on the experience of other countries, notably Great Britain and America. In the latter it is held that, taken over a period of years, ground carbonate of lime is better than burnt lime. This is supported by English experience. For agricultural purposes, ground carbonate is the form chiefly used by farmers in New Zealand. As to your query (*c*), quantity per acre necessary : This can be better determined after your soil has been analysed. Generally speaking, 15 cwt. to 20 cwt. per acre of ground carbonate is commonly applied on land that has not been limed previously, and approximately half that quantity of burnt lime if the latter form is used. Where freight is a consideration, burnt lime is often cheaper to use. Burnt lime is objectionable because of the difficulty in applying it, both for men and horses. Again, when stored in bags in our damp climate it slakes and bursts the bag.

RICE AS A POULTRY-FOOD.

J. B., Southbrook :—

Would you please state the food value of rice-flour (ground, unpolished rice) as a poultry food, and in what proportion it should be used in the place of wheatmeal with bran, in the mash ? Would it be suitable for other than winter feeding, and is it of value in egg-production ?

The Live-stock Division :—

For promoting egg-production we would not recommend the feeding of rice in any form, as it does not contain sufficient of the elements necessary for a high yield. If, however, it can be purchased at a low cost as compared with wheat-meal there is no objection to a small portion of rice-meal being included in the mash—say, a half part with one part wheat-meal and two parts bran ; but owing to the low protein content of rice it would be necessary to add a fair amount of animal food to the ration in order to secure the best results. For growing stock an amount of rice-meal double that stated above might be used.

SUBTERRANEAN CLOVER AND LUCERNE.

A. B., Woodville :—

Could you enlighten us as to the feeding-value of subterranean clover, and as to whether a crop of it would compare favourably with lucerne? The plan we have set is to put down about 15 acres of this clover this autumn for early feed next spring; feed it hard until the end of November, then allow it to seed; after seeding, feed it off, give the paddock a double stroke of the disks, manure, and roll. Should this be successful? We understand the plant is the only one to retain its fattening qualities after seeding. Is this so?

The Fields Division :—

Owing to the high cost of subterranean-clover seed, which is extremely difficult to harvest, only small quantities have been sown in New Zealand, and it is recommended exclusively for incorporation in mixtures suitable for light sand-dunes, the lighter, poorer classes of hill country, on bracken burns, and on sharp gravelly soils. It is a native of the drier parts of Europe, Asia, and Africa, and hence is suited to such conditions where the better clovers may not be profitable. Subterranean clover can in no way be compared with lucerne either for yield or feeding-value, being only an annual, germinating with the first autumn rains, and yielding herbage during winter, spring, and early summer. The growing-period would be practically over by November, and it would be advisable not to stock too heavy at that time, so as to encourage its rapid spread. There is no necessity to either disk or roll the paddock, but certainly a dressing of a quick-acting phosphate, such as super, would increase the rapidity of growth. With reference to the fattening-qualities of subterranean clover after seeding, probably you refer to the seed-heads being a concentrate, but it is doubtful whether this can be counted on, as under ordinary soil-conditions only about 20 per cent. of the seeds remain to ripen above ground. From this point of view it could not be compared, for instance, with the Australian burr clover, which in drought periods is sometimes the sole maintenance of stock in parts of those States. We are of opinion that in your case a pasture composed entirely of subterranean clover would not prove economical, as during summer the paddock would be practically bare, and thus allow the influx of weeds or worthless grasses.

SUSPECTED PHOSPHORUS POISONING IN EWES.

W. E. T., Waiau :—

Some ewes were suspected of being poisoned by phosphorized pollard laid for rabbits. How can one be sure of this? And how long would a ewe take to die after picking up the pollard?

The Live-stock Division :—

Phosphorus is a corrosive poison, and causes gastro-enteritis, manifested by great thirst, purging, and vomiting, the vomit being of a dark-green colour. Symptoms vary with the amount of the poison taken and the amount of food in the stomach and intestines. If the dose taken is large, the symptoms exhibit themselves very rapidly, and death takes place in a few hours. With a lesser dose it may be five or six hours before the symptoms appear in the form of colicky pains, tenderness of the abdomen, and a diarrhœa in which the excrements have the characteristic smell of phosphorus. Delirium, convulsions, and coma appear shortly before death, which may take place within a day, or may even extend to twelve days according to the amount taken. On *post mortem* examination the contents of the bowel give off the characteristic smell, and if placed in the dark have a luminous appearance. In chronic poisoning with phosphorus (where the animal is receiving small doses for some time) the heart, liver, kidneys, &c., show a fatty degeneration, in which case they have a yellowish appearance.

When dairy cows are dry, succulent and highly nitrogenous feeds are not necessary. Rough winter feed on pastures, grass hay, and roots, swedes, turnips, or mangolds are all suitable,